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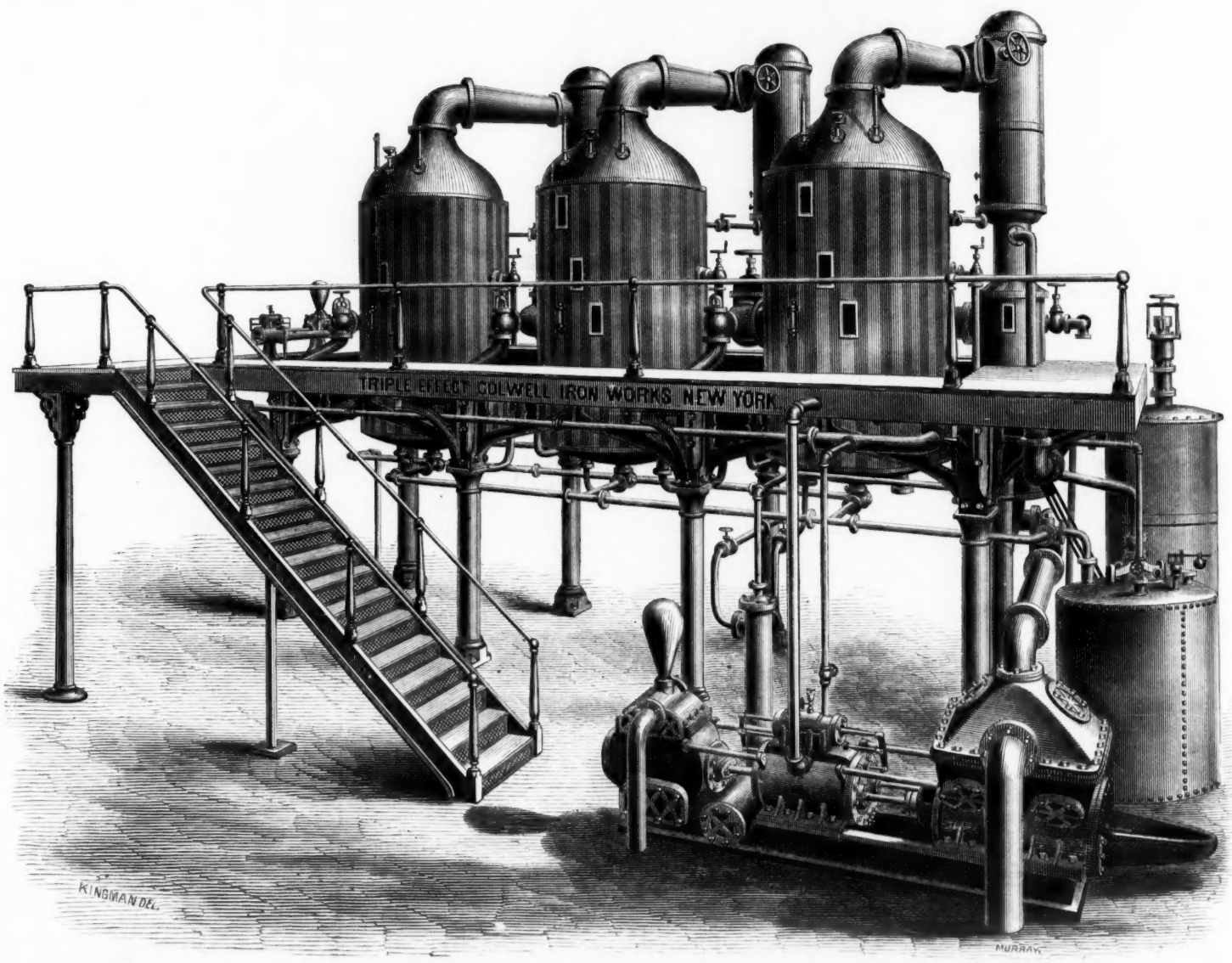
Sugar and Sugar-Making Machinery.

The method of the manufacture of sugar, as formerly practiced, was probably the most barbarous of the arts. Recklessness and wastefulness, fostered by the existence of slavery, were adequately represented by the wind-mill and the Jamaica train. In order to express the juice satisfactorily a sufficient force, or power, exerted at a uniform speed and of certain application, is essential. The mechanism selected was usually a wind-mill having vertical rollers, very irregular in their action, generally feeble in their power, and most capricious in their operations. To concentrate the juice it was exposed to violent heat, while the thickened juice should be treated with the most jealous care. Accordingly a form of vessel was selected which presented the greatest capacity and smallest heating surface, and as if in order to subject the juice to further injury a battery of vessels of this character was arrayed, which required the juice to be under treatment for hours in succession. Furthermore, by the device of ladling the syrup from vessel to vessel, portions introduced in the morning, remained (mingled with more recently added juice) at the close of the operations of the day. It remained only to apply the fire in its full fury to that portion of the battery, the contents of which must, from its action, complete a system, the folly of which is unrivalled in technology. Not only is this method culpable, but it is costly. The number of men and women employed about a boiling-house, skimming and potting, is out of all proportion to the sugar made; nor does the waste end with the process. Much of the juice is left in the cane, and of that which is not converted into caramel and molasses by the fire, a considerable portion is destined to drain away in the ship's hold.



TRIPLE EFFECT EVAPORATING APPARATUS FOR SUGAR MAKING.

By the introduction of improved machinery planters enjoy a great deal of time and money, which would otherwise be lost. The true remedy for the enormous waste that attends the present mode of manufacturing raw sugar must be found in the application of a regulated steam heat, with coals for fuel, while the cane trash should be left to the more legitimate application of manuring the land for future crops. The waste of sugar by the old process has attracted the notice of French as well as English writers; thus Dumas states that "of the 84 to 90 per cent. of the juice in the fresh cane, only from $\frac{2}{3}$ to $\frac{6}{7}$ are obtained from the mills of the sugar actually existing in the juice of the fresh cane—six per cent. being left in the trash which is used as fuel. So that for every eighty million kilogrammes of raw sugar imported into France forty million kilogrammes have been burnt in producing them, the value of which (about 20,000-000 francs) is actually thrown into the fire." Mr. Kerr remarks that "the whole system, from the breaking up of the first clod of earth to the rolling of the hogshead into the ship appears to have been contrived for employing the greatest possible amount of labor."

Since the invention of the vacuum pan, by Howard, in 1812, very little improvement has taken place in the design of the pan, disposition of the heating surface, or the proper conduct of the vapors or their condensation, until within the last few years. The Colwell Iron Works, foot of West 27th St., New York, have given the vacuum pan their especial attention, and have succeeded in meeting the wants of both planters and refiners. They have made one hundred and eight pans within a short time, mostly after the style represented by the engraving on page 3.

To describe the process of manufacturing sugar with best approved modern machinery, we commence with the cane mill, it being understood that steam boilers and the necessary engine are employed. Without an efficient mill a large part of the farmers work is lost.

In the best constructed mills, a great deal depends upon adjustment of the distances between the three rollers. A too near approximation causes, on the one hand, an increased expenditure of force in the working of the mill, and, on the other, a too great distance allows a portion of the juice to escape extraction, only to be carried off in the bagasse, or cane trash. The distance between the feed rollers being governed by the delivery of cane from the carrier, it is important that it should be laid on the cane carrier evenly, and not crossing at right-angles, otherwise the rolls may become jammed, and something must break or the engine stop. The bagasse, as it comes from its carrier is emptied into carts and spread upon the ground, around the sugar house, and, if properly crushed, will require but little drying before it is fit for fuel.

In the cane mill illustrated on page 2 the crushing rolls consist of three long cast-iron cylinders mounted between the massive cheek pieces, and so set that the periphery of the rolls is nearly in contact.

These rolls are keyed on a wrought iron or steel shaft, carrying at one extremity the gearing by which the rolls are moved. The shaft of the upper roll is made of considerably greater strength than those of the others, as it has to sustain simultaneously the strain of both. The feed and delivery rolls have flanges at their ends, between which the top roll is placed. These flanges are for the purpose of preventing the pressed canes from escaping into the mill-bed. Care is taken in selecting the quality of the iron for the rolls because if too hard they have not the bite necessary and are slippery; but if, on the other hand, they are too soft, holes wear in them, leaving the cane only partially crushed. The

cheeks are securely bolted to the bed, which at the same time is so formed as to receive the inclined pan placed to catch the juice from the rolls. The whole mill is bolted to a massive stone foundation, solidity being absolutely necessary.

The cheeks are formed with pockets for the purpose of receiving the roll bearings. These bearings consist of a single brass bushing with a projecting tongue on the bottom side which fits into a groove in the cheek, by which means the bearings are guided laterally.

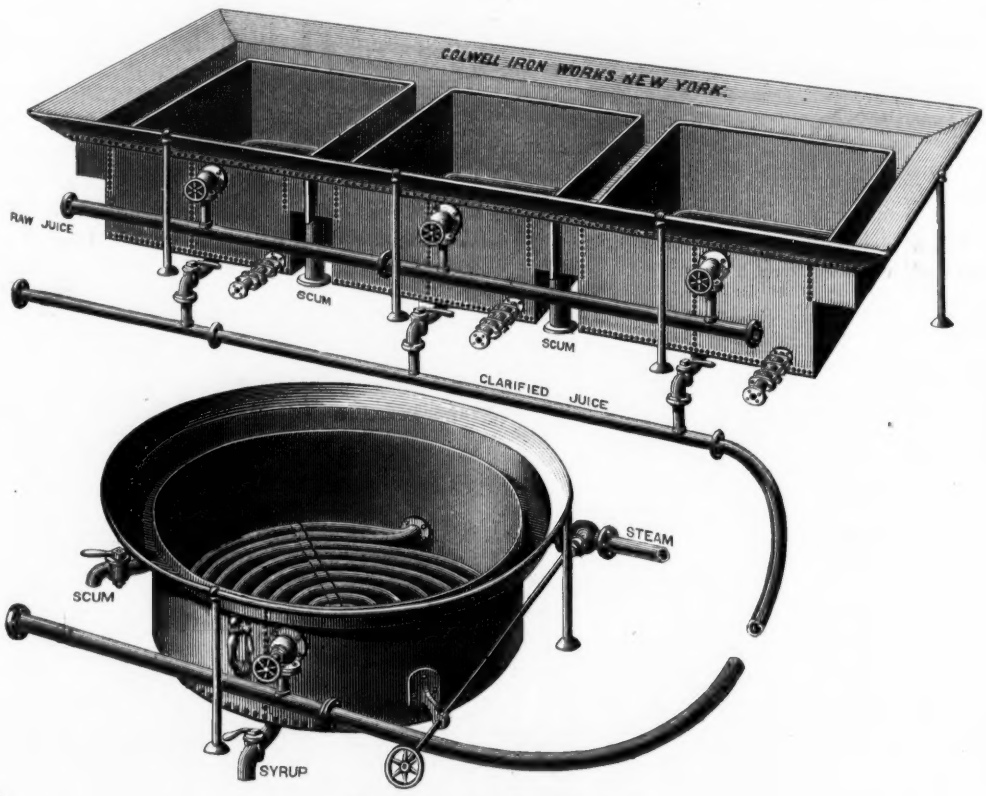
To regulate the distance of the rollers from each other, and to compensate for the wear and tear of the bearings, these latter are so formed as to be capable of removal to a greater or less distance from the center of the mill, by means of a strong screw passing through the end of the cheek opposite to the center of each bearing—the screw working into a nut sunk into the cheek. The ends of the cheek through which these screws pass are further strengthened by uniting with the head stock by strong belts, after passing through the sleeve and secured by a well fitted wedge.

The upper roll revolves in brass bearings, surmounted by massive caps, which are retained in their places by strong bolts, which, traversing the whole height of the cheeks, are secured under the bedplate by means of cotters. Between the lower rolls is placed the return blade, or knife, which is a concave wrought or cast-iron plate secured to a beam of wood, with the ends arranged to project through openings in the side of the cheek. They may be elevated or depressed by means of a screw or wedge. This knife directs the cane, which has been crushed between the top and feed roller, to the top and delivery roller. The three rolls are set in motion by the strong spur pinions or crown wheels fixed by keys upon the extremities of their respective gudgeons, and gearing together. The pinion of the upper roll, which communicates motion to the others, is itself set in motion by gearing connected with the steam engine.

The *defecation* of the juice is produced by heat, which coagulates the albumen, and by the addition of the milk of lime, which neutralizes the acid and renders some of the insoluble impurities soluble.

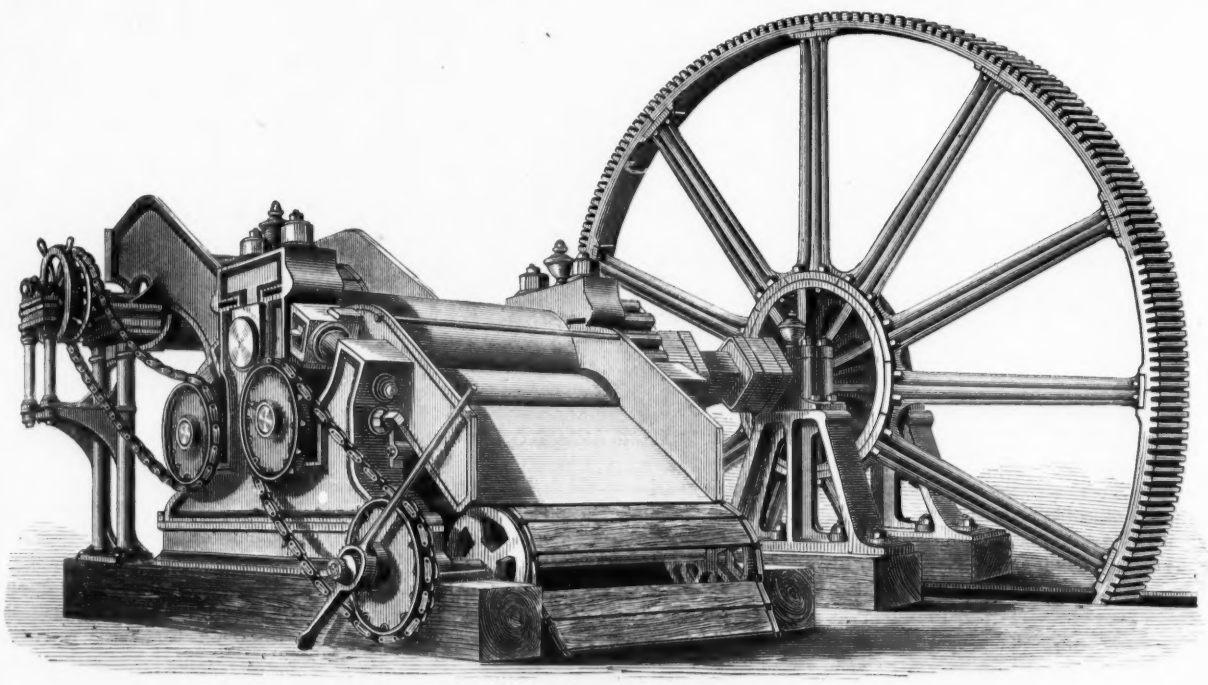
The proper dose should be measured out by means of a vessel which is graduated into inches, corresponding to 4½ ozs. of milk of lime, using $\frac{1}{1000}$ to $\frac{3}{1000}$ of the weight of juice.

The upper cut on this page represents the open steam train. When this apparatus is understood by the farmers, raising sorghum largely is likely to result. Its action is simple, positive and cleanly. A turn of a valve controls the heat, and there need be no burning. In the three oblong tanks are copper coils; between the tanks is the scum trough. We will suppose the defecators full of raw juice. The milk of lime is added, the quantity depending on the quality of juice; steam is turned on, the scum rises and after a time cracks; little bubbles are formed, and the defecation is judged to be complete. Steam is then turned off, the scum lifted off into the trough at the side and front, and washed away while the clear liquor is drawn off into the round evaporator, where a higher degree of heat is applied, and a rapid evaporation is the result. During the first part of the boiling a scum is raising and flowing outward, which is received into the inclined trough which allows the juice to flow to the front, and by means of a cock permits it to return to the body of the juice while the scum is retained and sent through its proper channel. Soon the liquor cleans and the evaporation is continued until the juice is to the required density, and is ready for the vacuum pan. By this method the yield of sugar is not so great as in the "triple effect," as the boiling is in the open air and with a high degree of heat, yet it is vastly superior to open kettles.



Clarifier and Evaporator.

The aim of the triple effect evaporating apparatus, shown on our first page, is to economize fuel, and obtain a superior quality of sugar. In this apparatus the entire evaporation is in vacuum and at low heat. The principle of the triple effect is the same in all cases, whether with horizontal heating tubes, as in the Rilleaux, where the liquor is on the outside of the tubes, rendering it difficult to clean, or in the cut presented, where the heating surface consists of 2" vertical copper tubes contained within a copper drum with brass heads, into which the tubes are expanded. This entire heating surface is supended within the shell and admits of perfect circulation of the syrups and yet affords every facility for cleaning the tubes by scraping or acids. The deposit is due to the lime used in the defecation. Having a strong affinity for the copper, the lime is deposited during the operation of evaporation. The working is as follows: The exhaust steam is admitted to the heating drum of the juice, or left-hand pan, by means of a valve (preparation is made for live steam, if needed), and the pan is boiled. The vapor generated is conducted into the heating drum of the second pan by a large vapor pipe, and the second pan is boiled. The vapor here generated is conducted into the third, or syrup pan, and this pan is boiled. The vapor here generated is conducted to a jet condenser and killed or condensed, and the water and remaining vapor are drawn off by means of a vacuum pump. It may seem a little strange that the vapor of one pan will boil its neighbor, but it must be borne in mind that the first pan has little or no vacuum, and takes the full steam heat, while the 2nd pan will have 12 inches or 15 inches and require but 190° heat, and the 3d pan with 27" vacuum can be boiled with 140° of heat. Thus the latent heat of the steam is used and the last two evaporators act as condensers for those before them, and the amount of water needed for condensation is very much reduced. Where fuel is expensive and water scarce, this is the most economical method. The juice is admitted into the first pan, partially concentrated, passed to the second where the action is continued, and finished in the third, where the syrup is made, to about 25° Baume. From this pan it is drawn off by means of a pump or *mont jue*, thus the action of the apparatus is continuous.



Cane Mill.

The cut on page 3 represents a cast-iron vacuum pan mounted upon columns, for plantation use. This system is the best for working the syrup into sugar with the least steam, and the fewest men to handle the product. By means of the "recipient" the exhaust steam of the different engines and pumps is collected into one vessel, and by means of valves connected to the coils in the pan, which in the action of boiling act as a surface condenser. Instead of a back pressure this gives a vacuum on the machinery for two-thirds of the working of the "strike," while during the last third it may run up to about 5 lbs. back pressure, when the relief valve opens. It is then necessary to run with a little live steam The sugar being cooked it is discharged through a large valve in the bottom of the pan into a mixer, where it is gently stirred. On the bottom of this mixer is a number of valves one over each centrifugal machine, which machine takes a charge, purges it of the molasses, and the charge is passed through the bottom into convenient wagons placed to receive it. The molasses is conducted to suitable tanks until enough is collected to make a strike, which is reboiled in the pan to make second sugar. When sufficiently boiled (to "string proof,") it is delivered into cars or crystalizing wagons. These being placed in a hot room allow the crystal to grow until the wagon, which first contained but a fluid molasses, contains hard and firm sugar fit for the mixer and centrifugal machines. Here the operation is the same as for first sugars.

The cut, although representing a vacuum-pan with accessories as applied to a sugar plantation, has the characteristics of the pan as used in a refinery.

Each has the overflow vapor pipe and condenser. The plantation works on the "wet vacuum" principle, while the refiners adopt the dry vacuum or barometric column, as it is important to work closer than on a plantation. The heating surface is 4" seamless copper tubes arranged in a serpentine form, delivering the condensation at the center, which is conducted back to the boiler.

The mountings are the steam valves, thermometer, vacuum-guage, sightholes, butter cup, charge valve, and discharge valve.

The method of evaporation and crystallization detailed in the foregoing is much in use in Cuba for cane sugar, and in France and Germany for beet sugar, but as yet it has not been applied to any extent to corn sugar or glucose. The Colwell Iron Works are at present constructing a double effect evaporating system for Peru, this being the third sent there within two years; also a very large triple effect for the Sandwich Islands, and a smaller one for a beet sugar factory. With the delicate beet sugar juice it is a necessity to do all the evaporation in vacuo, and recourse to the triple effect system is necessary. Machinery after these designs is now in course of preparation for plantations and refiners, beet-sugar factories, sorghum farms, and also for the manufacture of glucose and grape sugar from corn.

Few persons realize fully the enormous sums of money that this country is paying for imported sugars, or the equally enormous advantages that would ensue to our people from substituting a profitable industry for this incessant drain. Many efforts, especially, have been made to push the culture of sorghum, but the difficulty of converting it into sugar of good quality in profitable quantities has hitherto stood in the way.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * There are a lot of mechanics who manage to get into every shop in the land, who judge of possibilities entirely by their own weak accomplishments. They are the ones who do the grumbling. Their weak minds never understand the circumstances around them, and they foolishly and blindly give utterance to the stereotyped growl, "There's no show for a mechanic." It is the miserable and contemptible example of such men that keeps boys with stuff in them out of the shop. They sagely tell the inquiring youth not to go into a shop, that there is no decent show in the world, that they have been there and know. Now, Mr. Editor, these men lie. They never have been there, they don't know, and there is a show. The smart mechanic of to day has before him a possibility of prosperity, of usefulness, of social position, of home comfort, and general respect, such as the lords of earlier centuries, with armed retainers, with no forks, and with dogs under the table, never dared to dream of.

No mechanic in this country dares lift his head and say his children must do without education, and go to work at twelve years of age. No mechanic in this country, when he squats in a town, is compelled to hunt up a dirty hut to live in, and pay a premium on it because it fronts on a sloppy alley.

The mechanic in this country cannot lay special claim to a dirty home because he is a workingman. The eggshells thrown into his slop-yard may be filthier and dirtier than those of his decent neighbor, but it is not the result of his being a mechanic, for his neighbor is one also. When his dirty little girl goes to school in the morning, her dirty stocking may slouch down off her leg and upon her miserable shoes, but it can't be explained by saying that these stockings are dirty and slouched down because they are on the legs of the daughter of a workingman. The explanation would fail for the simple reason that two-thirds of this girl's trim and neat companions are daughters of workingmen. The comforts of life and home are within the reach of all American workingmen. The best of things that are printed, the finest efforts of the stage, and the best of home comforts, the American workingman may enjoy. There is no social bar whatever to his political distinction. He may choose whether he will frequent the finest homes in the land or the lowest pot houses. If he is a low down blackguard he will be refused decent society, not because he is a workingman, but because he is a blackguard. Every prospect for the future which this wide world holds out for its choicest people, this land holds out for the smart mechanic. And the shiftless, ignorant, thoughtless sluggard sees no show for the workingman. There is a show, all the show, but maybe none for him. The sensible mechanic don't gauge his own accomplishments by the contemptible lack of effort of the ignorant howler.

* * * * Is there no show for machinists, Mr. Editor? Turn to the last pages of the AMERICAN MACHINIST, and there read the biography of the workingman. The advertising pages tell the tale, sixty men put their names on those pages. They employ five thousand workmen, and over six million dollars of capital.

Were these sixty men born with these millions in their pockets? Did they fall heir to the cash and the shops at an early age? Not a bit of it. Look here: At the age of eighteen over forty of these men were working in shops, drilling set-screw holes in pulleys, cutting bolts, chipping new holes in old boilers, contriving ways and means to get old broken studs out of old cylinders, forging square keys out of round iron, butt-welding erroneous connecting rods, gouging out core boxes, gluing up segments, spitting white pine dust, cutting up old boilers, building up new boilers, putting in good rivets, cutting out old rivets, bedding floor moulds, ramming copes, filling cores, and doing everything one man does for another man's money. They were not preparing themselves to take charge of probated fortunes. They were working. Of these forty men, thirty did not at the age of eighteen have fifty dollars they could call their own. Of the five thousand men they now employ, three thousand were then their shopmates.

Among these sixty men can be found the names of some of the highest social powers in this land of ours. High toned society made no exception among the three thousand and sixty. Society never said to one of the sixty: "We find a birth mark on you; twenty years from now come to us." Society never said anything. The sixty said. Fortune never said: "I see a mark; come to me." Fortune never said anything. The sixty said. The five thousand in the shop never said to the sixty: "We see a mark on you; shoot ahead and we will lag and work for you." The five thousand never said anything. The sixty said. Providence din't chalk out a future for the sixty. The sixty did their own chalking and left the five thousand to lean on Providence.

Civil law never said, "sixty of you chaps must be smart and prudent—thrifty—and five thousand of you must starve in pot houses after work is over." Law don't push men forward. The sixty did the pushing.

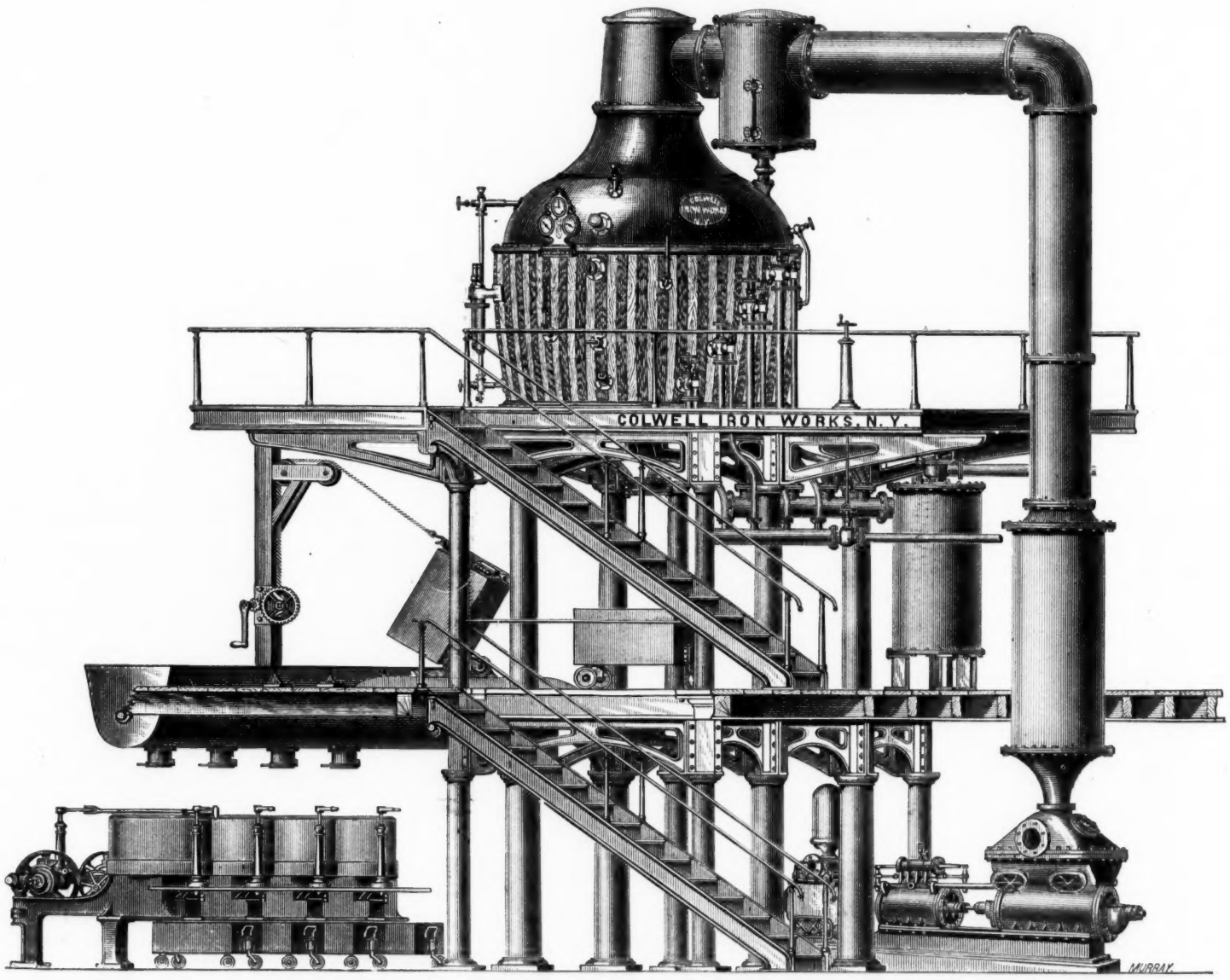
A low down blackguard blows the fumes of cheap whiskey in my face and tells me there is no future for a mechanic. Oh no! of course not. If a man is foolish enough to learn the machine trade, of course he can never hope to call a pane of glass or a rose bush his own! Of course, he can never hope to take a daily paper, or to own a copy of Comstock's philosophy, or twenty dollars worth of general books, or to be called on to rule in public councils, or to head a public charity, or to see his children well educated!

There's no show of course If a man ever touches a chipping hammer, a wise people will never call on him to govern the state. If he ever splits a rail good-bye to all future prospects.

* * * * Mr. Editor, if you know of a bright sixteen years old boy, smart and independent, with snap, pride, poverty, good health, and a common school education, and with a hankering after the mechanical arts, tell him to go into a machine shop and learn the trade. You can appear disinterested, but some day he will be your advertiser.

Tell him when he earns money to hunt up some way to spend it all before the next installment is due; tell him to learn only one way of doing things and to fail when that way won't fit; tell him he is to get rich, not by the amount saved but by the amount of wages received; tell him never to look into the human nature of his foremen and fellow workmen; tell him always to hunt up the slums to live in when he moves to a new place; tell him to cultivate the habit of playing seven-up in a saloon two hours every night; tell him to buy his groceries by the quarter's worth; tell him when he is dissatisfied with his wages, not to go to the office by himself on his own merits, but to find a dozen other fellows, eight of whom already get more than they are worth, and march into the office and demand a raise or threaten a strike; tell him never to hesitate to spend six months' wages to get to a three months' job at ten cents a day more; tell him to associate with machinists only; tell him never to pay six dollars to take his folks to the opera, and never to miss a low performance; tell him never to read anything relating to the past, present or future; tell him never to clean up before he goes home, and never to allow his home and family to be as neat as a millionaire's; tell him to take his children out of school as soon as some one will buy them at a dollar a week; tell him all these things, Mr. Editor, and see that he lives up to them and he will never be your advertiser. He will curse you to his dying day, and will tell you a workingman has no show in this country.

* * * * *Norman*, in your issue of March 6th, states that a late letter of mine provoked discussion. This is gratifying and pleasant; were I a high and mighty power, able to suggest and dictate plans, I could do much good indeed, but, as it is, the utmost I can expect of myself is the ability to turn thought in some certain direction. Thought resulting in discussion, should result in settled plans. I was in hopes that the very empty termination of my former remarks would lead to suggestions as to failures or successes,



VACUUM PAN, WITH COMBINED VACUUM AND WATER PUMP, AND STRIKE MIXER CENTRIFUGAL MACHINE.—SEE PAGE 2.

Men don't like to tell about such things much, and men like Norman, who will tell of a failure, are rare.

If a man is of a prudent character, he will act like all prudent men, and will succeed and fail as all prudent men do. No bank is sure; but the best business men deposit in them. If a wealthy man loses all by a bank, he suffers indeed, for his living capital was there. He must change his course of life, and commence his life's work anew. The workman's money in bank is strictly a surplus, and its total loss need not affect his life to-day or to-morrow one jot or tittle. But it won't do for a person, who at middle age commences to save, to lose it all. It is apt to stop the thing. Men who have never saved, and who propose to save, should have a sure thing on it. Savings banks are not a sure thing; in no State is a depositor guarded absolutely against discouraging losses. Besides that, there is nothing compulsory about deposits. Building associations are, in many ways, superior, especially in some States. The deposits are compulsory, and the securities excellent, though not absolute. Loans are dangerous, when effected by inexperienced men. Profit on savings is no object to the class I speak of. The saving itself is the main thing. Real estate, bought on small notes, is a good investment, if the land is not a swindle. Owning a lot, whether there is a house on it or not, is not a tie to any workman. If he loses his job, he can go elsewhere and work; his real estate don't need to hold him; he can go just as though he didn't have any. If he can sell it, or can't sell it, he ought not to sell it; if it can't be rented, don't rent it; if taxes must be paid on idle property, pay them. To the class I speak of, the privilege of owning something is worth paying for. The idea that John Smith can't work in Pennsylvania because he bought a lot in Michigan, is a shallow idea. If the lot is in a good place, it don't make any difference where the job is; the further off the better. You won't be so apt to sell the lot. Stock in corporations is dangerous to the class I speak of. Such investments need control. The owner has no chance and no capability. Government bonds are the very best investment; they are as safe as can be; the trouble is in the size of them. The ten dollar certificates were exactly the thing, but they were soon used up. If Mr. Sherman would arrange for an issue of several millions of dollars, in similar certificates, *without* interest, convertible into interest-bearing bonds, in sums of five hundred dollars, the workman would hail the day. Money invested in such things is idle, of course, but idle money beats no money at all. If such certificates should be issued, manufacturers would see that their men get them. To a machinist who has a chronic case of squander on hand, and who wants to get well, I can suggest a plan as sure and certain as the stability of this government. It is this: Every pay-day, go to the post-office and get a money order for your extra cash. Don't try to make the figure even, but for any amount, seven, nine, eleven, or seventeen dollars—anything you can; don't dare to make the order larger. Get the money-order on pay-day, sure. Have the order made payable to the Treasurer of the United States, and take it home. This is safe; no one can get any good out of them, if they are stolen; if burnt up or lost, you can get duplicates. Do this every pay-day; never miss a single one, under any circumstances, and when you get a hundred dollars' worth, take them to any bank, or to the man you work for, and buy a hundred-dollar Government bond. Have that bond registered by all means. * * Very respectfully,

CHORDAL.

The Economic Feed Water Heater.

We illustrate upon this page some views of a new feed water heater, manufactured and now being introduced by the Hampden Foundry & Machine Co., Boston, Mass.

The exhaust steam from the engine enters at the steam inlet, passes in a direct unimpeded course through a channel provided for it, which is of a similar sectional area throughout, to the steam outlet, from which the exhaust pipe conducts the steam not utilized in heating water away in the usual manner. The channel is open at the top to the lower side of a tube plate; screwed into the tube-plate are a number of vertical tubes, open to the exhaust steam at the bottom, but closed at their upper ends, which are left perfectly free, and thus individually at liberty to expand or contract without straining. In each of these heating tubes is a small circulating tube leading from near their upper ends to the channel through which the exhaust steam passes (at an average speed of nearly one mile per minute), and where these mouths are so arranged that the passing steam causes a strong induced current out of them, and thus

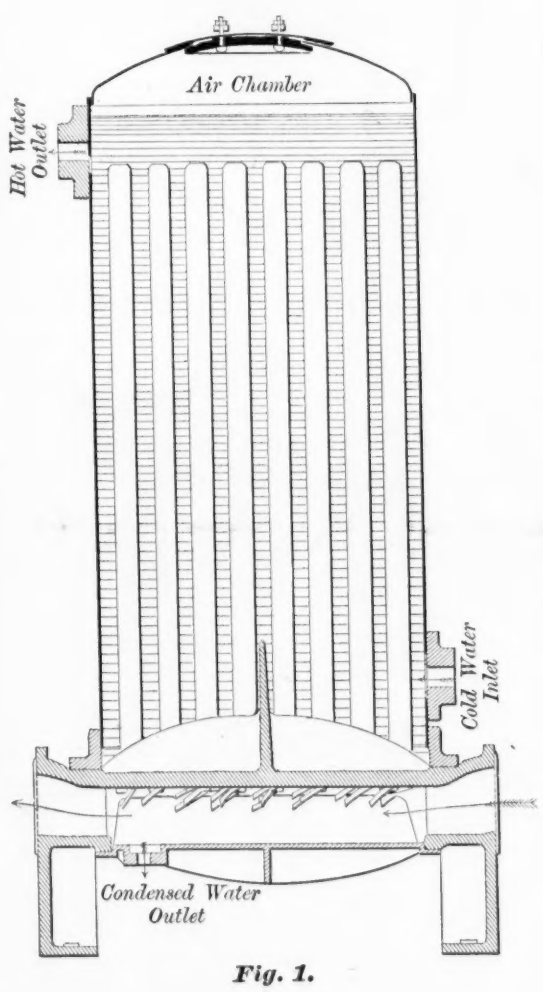
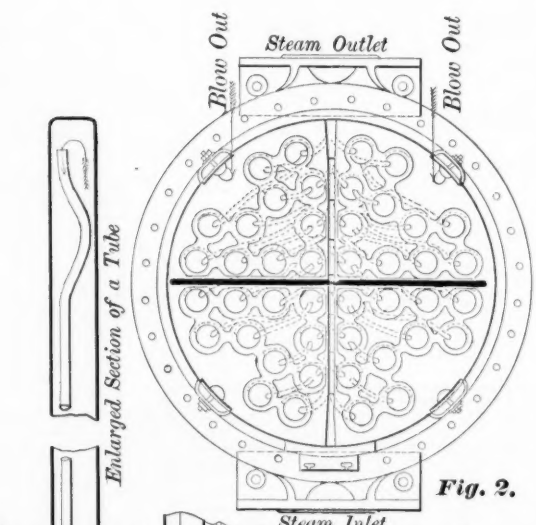


Fig. 1.



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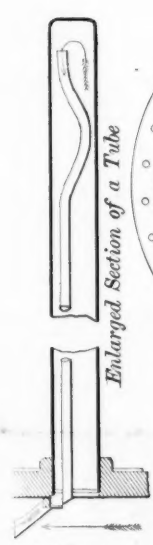


Fig. 4.

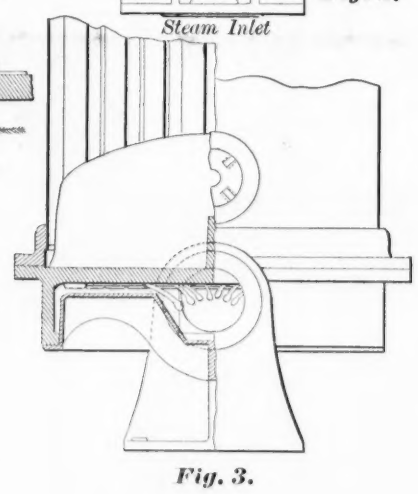


Fig. 3.

out of the upper ends of the heating tubes, rapidly removing the air which they contain on first commencing to work, or which may be carried in with the exhaust steam, and causing the very slight amount of exhaustion required to draw up and fill them with steam. A small portion of the heating tubes projects into the exhaust steam, and assists in diverting it into them. The heating tubes are thus filled with exhaust steam at a constant temperature of 212° F., and projecting into the water cylinder, rapidly transmit this heat to the water surrounding their outer surface, automatically drawing up as much steam as they require for this purpose, and allowing the rest to pass on unchecked, but being reduced in volume by from one-third to one half, it passes through the remaining length of the exhaust pipe with less resistance, and thus the engine is claimed to work with less back-pressure than if the heater was not attached.

The water is pumped, or otherwise forced, into the lower part of the water cylinder, where it is rapidly heated to a boiling temperature, the hottest water rising to the upper part, from which it flows into the boiler without requiring to be pumped in its heated condition. The water cylinder is large enough to contain a considerable quantity of water which is kept at a high temperature, under pressure, for a length of time sufficient to cause it to deposit a large proportion of its impurities; the lower part of the water cylinder is divided by a partition, which prevents the disturbing influence of the entering cold water from affecting the water on its other side, and thus allowing the impurities to settle there as soft mud (the temperature not being high enough to harden it). Provision is made for attaching a blow out cock (or cocks); this should be opened occasionally to remove the mud and prevent its entering the boiler, which is thus supplied with purer water. The feed relief valve may be placed on the feed pipe on either side of the heater; it is only necessary when a pump is used.

These heaters are claimed to contain not less than three square feet of heating surface per horse power, this being found, it is claimed, sufficient to raise the feed water from 40° F. to 212° F., the temperature of exhaust steam. The tubes of the heater being fixed by one end only, are free to expand and contract without the slightest injury. The tubes are screwed into the tube-plate, thus making a tight joint. The water cylinders are made strong enough to work with boilers whose blowing-off pressure is 100 lbs. per square inch. It is claimed that no back pressure is produced. To provide facilities for cleaning and examining, the heater has a large man-hole in the top, and mud holes through which the whole of the interior can be cleaned and examined without interfering with any large joint or any of the connections even while the engine is working. If any scale should adhere to the tubes, it will not be hard, as the temperature never exceeds 212° F. It can easily be washed or scraped off, will fall to the bottom, and can readily be removed with any loose deposit through the mud holes. The water is pumped whilst cold into the heater, and forced through it into the boiler, so that the pump is always certain in its action and the same pump will also raise the water. The water may also be forced by an injector, or the pressure in the main, and no pump required.

The wages at the mill of the North Pownal (Vt.) Manufacturing Company were advanced ten per cent. on Monday last.

J. C. & E. A. Alden, Springfield, Mass., have raised the wages of their woolen factory operatives 15 per cent.

Experiments with Fly-wheels.

BY F. F. HEMENWAY.

I have a friend whom we will call Jones, because it is a good enough name, but chiefly because it isn't his name. Jones is generally considered level-headed; in fact the only chance for a charge of lunacy to lie against him is that he has devoted some of his spare energy to working up an automatic cut-off for steam engines. That is, he has concluded to add one more to the somewhat extensive list of "The best in the market." Some one with an eye to economy, advised that he buy or borrow some scrap-heap engine, and set his traps jigging on that, just to see how they would work; but Jones showed his good sense by concluding that that would be a good way *not* to find out anything about it. Jones' first idea was for a 12″×36″ to turn up at 100 revolutions, but he got to reading up on short stroke, and finally wavered between a 12″ × 36″ at 100 revolutions, which he liked, and a 12″ × 18″ at 200 revolutions, which would show how easy his cut-off could get around the corners. He says when he began to read up for proportions his real difficulty began. He puts his case rather strongly; says he could make his shaft and pins anywhere from 2″ to 7″, and prove by eminent authority that they were just right at that; but finally compromised by copying the sizes from another engine. When he came to fly-wheel, however, he wanted the full benefit of the knowledge of scientific investigators. His researches in this direction are interesting, perhaps instructive. The necessary weight of a wheel of a given diameter, as calculated from the formulas of different authors, covered all the ground from 250 to 3,700 revolutions, and he wasn't satisfied with the variety offered at that. Concluded his authority was too old—formulated before they knew *all* about fly-wheels. He got hold of two recent works, and sat right down to find *exactly* what he wanted. He came around two or three days after with both books under his arm, and a nice little memorandum of his efforts after uniform motion, from which I quote:

"Weight of 10′ fly-wheel for engine 12″×36″, at 100 revolutions, 50 H. P.

"As per formula from A. C. 3185.

"As per formula from B. E. C. 3250."

Jones was happy. It was clear to him that two authors who agreed so nearly as this must individually and collectively know what little was worth knowing about fly-wheels, and he tackled his 12″×18″ with perfect confidence, and the following results:

"Weight of 10′ fly-wheel for engine 12″×18″, at 200 revolutions, 50 H.P.

"As per formula from A. C. 398.

"As per formula from B.E.C. 812."

Jones intimates that to say he was discouraged would be "drawing it mild," but he concluded to try it again with an 8 foot wheel. Probably his 10′ was too large for the stroke. Didn't square right with the 169,000,000 "constant"? It showed up as follows:

"Weight of 8 foot fly-wheel for engine 12″×16″, at 200 revolutions, 50 H.P.

"As per formula from A.C. 622.

"As per formula from B.E.C. 1005."

Jones was by this time as completely disgusted as he had previously been delighted, and came to the conclusion that one or both of his authors had mistaken their calling. What troubles him is why they agree on the 12″×36″ at 100 revolutions, and don't even agree to disagree on the 12″×18″ at 200 revolutions. * * I lost sight of Jones for about six weeks, but he turned up again last night. He had a kind of forlorn look, as if every

one hadn't used him right. Says he got right down to solid business on the fly-wheel question. Bought an indicator, duplicated every one of Chordal's attachments, and had that indicator harnessed to every automatic engine within a radius of 10 miles, and took the dimensions of their respective fly-wheels. Used all the balance of time in translating indicator to crank diagrams, and comparing the performances of the engines. Results: found a good many engines with wheels quite too light, running nicely, and others with very heavy wheels running poorly; likewise, *vice versa*. Conclusion: that a light or heavy wheel is best; but is not quite sure which. Jones believes if the engineers had not turned their attention to locking their doors as often as they saw a man with a box in his hand, he should eventually have settled it somewhat more definitely. He says he has found out one trade secret, and that is, how the builder, or designer, or engineer gets at the question. He says he constructs an imaginary diagram as different as convenient from the real one; carefully calculates dimensions from this, and then looks for a pattern or sweep that will give him something different, and in the end concludes his wheel is too light, or too heavy, but never quite settles which. Jones says he is going to a foundry to-morrow to order a 10′ fly-wheel, and if the proprietor asks him how heavy he wants it, he will cancel the order and go somewhere else. Now, Jones isn't a myth. There are a good many of him, and some one ought to labor with him to the end, that he may be convinced that we are in no need of additional knowledge on the fly-wheel question.

Pumps, both steam and hydraulic, of a handy description, are being ordered more freely by Australia, South Africa, and one or two of the other foreign markets. Messrs. Joseph Evans & Sons, of the Colwell Foundry, Wolverhampton, report that they have recently despatched several of their patent bullock and horse pumps, to be used in agricultural operations, to the Cape; and that amongst their home contracts are repeated orders for one of the London gas companies. American competition, which I have previously reported as severe in Australia, is looked upon as likely to be disadvantaged by the advanced prices which the United States people are demanding, and Staffordshire makers regard the better demand thence as indicative in part of this state of things. Most of the heavy ironfounders report themselves fully occupied in that department in which mill and forge castings are turned out.—*Ironmonger.*

A man in search of employes recently visited Hartford machine shops in vain. The proprietor of one establishment said he had refused $20,000 worth of work during the past two weeks, simply because he had already more than he could do. All the others were crowded with work.—*Holyoke Transcript.*

American vs. British Locomotives.

The interest and importance of this subject, have led us to devote considerable space to extracts from the comprehensive pamphlet just published by Mr. W. W. Evans, embodying the fullest data as to designing, expenses for repairs, durability, first cost and systems of running. We give below extracts from a letter of Mr. Evans to Thomas Higinbotham, Engineer-in-chief of the Victorian Railways, Australia, dated March 3, 1878:

You say there is a prevailing impression that the American engines will not last over five to seven years. I propose to give you a few figures on this matter to show to those interested in such things. I, some years since, saw in an English paper, the *Railway News*, a statement of the mileage of engines in England. I was so astonished at the small figures that I sent and got some data of English and American engines, so that I could compare them. This was in 1874. The figures were as follows for 1873, and give averages for the year of all the engines they had:—

English Railways.	*Miles.*
London and Northwestern, Train Mileage	15,415
Midland	18,808
North Eastern	17,290
Great Western	18,320
4)69,833	
Average of all	17,458

American Railways.	*Miles.*
Boston & Albany, Train Mileage	24,500
Erie	27,550
New York Central	26,933
Pittsburgh, Fort Wayne & Chicago	31,737
4)110,720	
Average of all	27,680

The above gives an average of 10,222 miles for the American engines more than for the English. This is decimally 58 per cent. greater duty, and it was done on inferior tracks, in a more severe climate, over steeper gradients and sharper curves, and with heavier loads. It must be admitted, in making this statement, that the English engines no doubt showed a greater average speed than the American, but, with this admitted, they should show greater average mileage in the year. * * * *

Then follow copious statements from different roads, from which we produce only one—from the Pennsylvania Railroad:

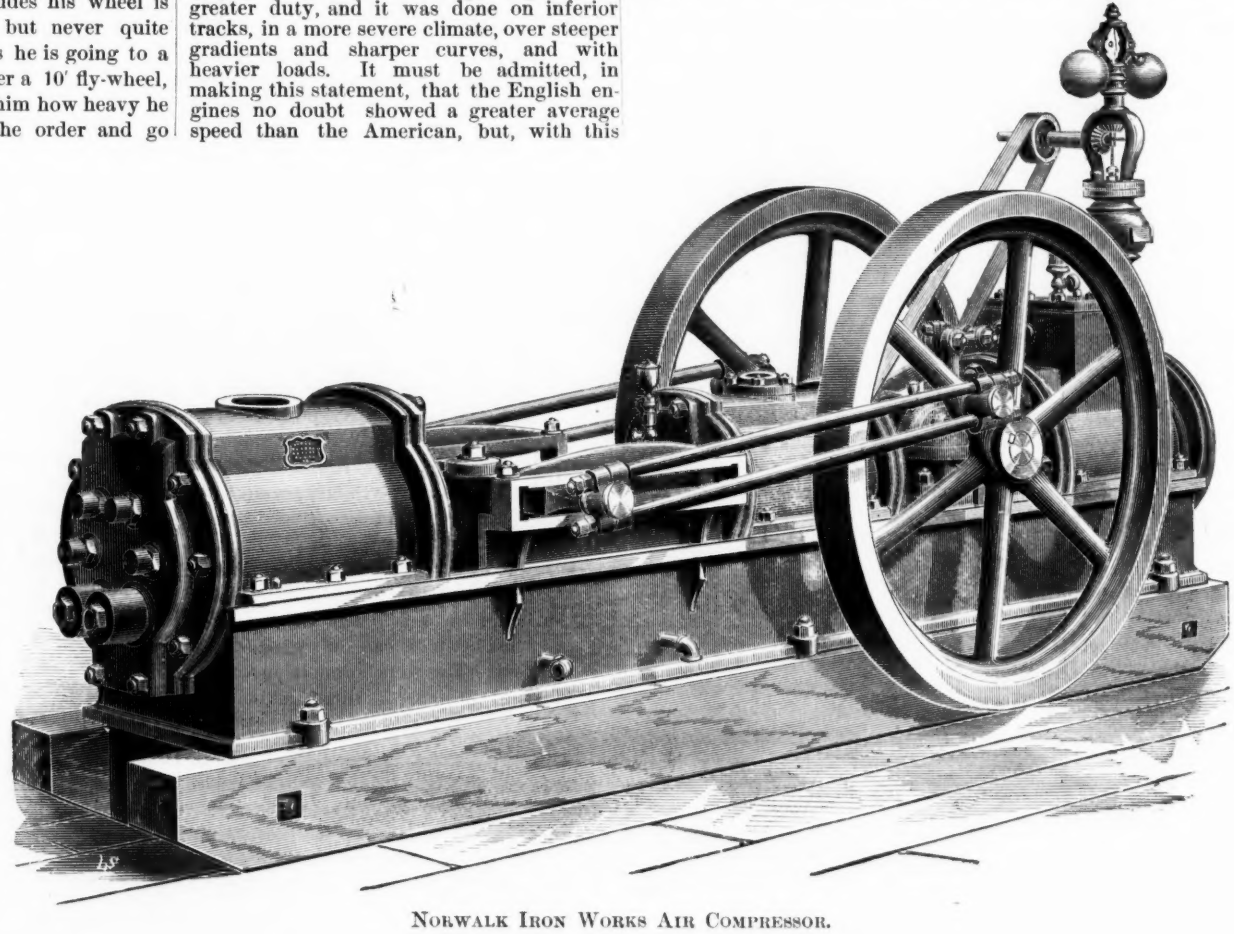
The report of the Pennsylvania Railway for 1874 shows the average of all their 786 engines, passengers and freight, to be for the year 26,263. One of these engines, No. 133, on Middle Division, is put down in this report as having run in the year 83,820 miles, on passenger trains. This gives the largest run of any engine on each division. Thinking this might be an error, I wrote to Mr. Ely, the Superintendent of Motive Power, to ask if he would confirm this tremendous run. He wrote me that this engine not only ran the 83,820 miles as reported on passenger trains, in 1873, but ran 2,904 on freight trains. This makes 237½ miles a day for every day in the year, and is much the largest run I ever heard of. You may depend on it that engines that can perform such duty are not toys or flimsy things. Taking 17,500 miles as the general average of engines in England, this mileage shows that this engine, No. 133, did 5½ years work in one year.

This same report shows that a freight engine, No. 215, on the same division, ran 48,012 miles in the year. The Pennsylvania Railway does not give the age of the engines or data to get it; but the Reading Railway does. They give No., class, weight, maker's name, date when first run, miles run in the last year, total miles run, and service employed on. I will give you a few figures from the company's report of 1875, giving data up to the end of their official year, 30th November, 1874, when they had 403 engines:—

No.	Class.	Weight in Tons of 2240 lbs.	When first run.	Miles run in Year 1874.	Total to Date.
23	1st	26.9	July, 1852	24,780	410,733
44	1st	26.2	May, 1857	25,484	438,541
45	1st	23.8	June, 1857	27,428	422,222
49	1st	25.2	Aug., 1857	28,593	475,733
57	1st	25.2	June, 1859	35,407	426,071
58	1st	25.2	June, 1859	35,142	455,428

The above-named engines were all built by the Reading Railway Company, at their own shops; they were all passenger engines; they had been running from fifteen to twenty years, and you will see that each of them did a large service in 1874. Taking 17,500 miles as a fair yearly average, these engines had been doing the equivalent of twenty-three to twenty-six years. I do not give the above figures as averages in any way. I selected them as giving large runs for the last year, and large totals. Some of their engines have five pair of drivers coupled that can run without complaint around curves of 600 feet radius. * * * They do good service, haul immense loads cheaply, and are easy on the track. * * * When Mr. H. Coneybeare, a member, was here, he told me the gentlemen of the Institution in Great George Street thought these engines were a "myth." I took him over to the Reading Railway, and showed him they were not a "myth." I placed him by the side of a curve—the sharpest there—600 feet radius, and told him to note that these engines run the curve without a squeak or groan.

You are right about the engines looking light, but they are not so in reality. They can do their work, and live to an old age. * * * *



Norwalk Iron Works Air Compressor.

Norwalk Iron Works Air Compressor.

Within the last ten years the subject of compressed air has grown to be a matter of general importance to those who have any interest in a motive power, that can be easily produced and stored wherever there is water, wind or steam power. The ease with which compressed air can be transmitted through pipes long distances with a very trifling loss of pressure, without being affected by frost or cold, and without liability of the pipes to deterioration by carrying the compressed air—all these advantages render it much more desirable for transmitting power than either steam or water. Although there are quite a number of designs of air compressors, and different plans of treating the air during compression, so as to eliminate the heat of compression, we still think the field of experiment and inquiry in this interesting branch of dynamic engineering has not yet been narrowed to its smallest limits.

We illustrate this week an air compressor made by the Norwalk Iron Works Company, of South Norwalk, Conn., which seems to possess features which ought to recommend it to those desiring a first-class, compact and effective machine, and one designed to combine high speed with great economy.

It will be observed that the steam and air cylinders are secured to a long box frame, which is rigidly held to the foundation by suitable holding-down bolts. The larger of the air cylinders (of which there are two), is bolted to one end of the box frame; in this cylinder the air is generally compressed to about one-half the required tension. It is then passed to the small cylinder, shown in the cut, in about the middle of the frame, and there the pressure is completed. At the other extremity of the frame, the steam cylinder is located, the piston-rod of which is prolonged, and passes directly through the high pressure air cylinder. Between the two air cylinders are placed the main slide and crossheads. Between the steam and high pressure air cylinders is the fly-wheel shaft, worked by crank pins in the fly wheels, driven by connecting rods connected to the main crosshead. There is also a governor for controlling the speed of the engine.

This is probably as compact, serviceable, and, as the manufacturers claim, as economical a machine of its kind, as there is in the market.

The method of cooling the air used in this machine during compression is carried out upon what is termed the dry system, by encircling the air cylinder by a water jacket, and by causing the water to circulate around it. The heat in the air is carried off by conduction. It is claimed in this machine, that the dry cooling action is carried out more efficiently than in any other, the air being submitted to this action in two separate cylinders. It is also claimed, that by the method of compressing air in two separate cylinders, as compared with one cylinder, with the same terminal pressure, the difference in favor of the compound system is about 46 per cent.

One feature in the practical working of this machine shows that the designers are alive to the mechanical principles that have been so ably worked out by Chas. T. Porter in his high-speed engines, namely: The reciprocating fly-wheel and proportioning the reciprocating parts to the velocity of the machine. The benefits to be derived from this, we doubt not, are greater in the case of compressed air than in the expansion of steam.

Altogether, the makers of this machine have produced an air compressor that is at once simple and strong, and combines within itself those necessary principles which are indispensable to make a machine of this kind a mechanical success.

To Compute the Area of a Circle.—Multiply the circumference by one-quarter of the diameter; or multiply the square of the diameter by .7844; or multiply the square of the circumference by .07958; or multiply half the circumference by half the diameter; or multiply the square of half the diameter by 3.1416.

A week ago the blacksmiths and riveters in Roach's ship-yard, Chester, Pa., received an advance of fifteen per cent. on their wages—an amount equal to one-half of all previous reductions.

Turbine Water Wheels.

BY SAMUEL S WEBBER, C.E.

No. 5.

In my last article I spoke about the various proportions of wheel chutes and guides, and this time I propose to consider the wheel itself and the shape of buckets. The first question, and one that is an open one to most people not familiar with the principle of the turbine wheel, is whether the wheel is impelled by the percussion of the water on the bucket, as it enters upon and into the wheel from the chute, or by the unbalanced pressure and reaction of the water as it leaves the wheel, or both. Many wheel men hold this last opinion, and construct their wheels to secure the action of what they consider to be the two forces acting on the wheel. I have calculated from data, obtained in various tests, the velocity of the water through the chutes, and in nearly every instance when the wheel was running at the speed when the percentage was the highest. The circumferential velocity of the wheel exceeded that of the entering water from 33 to 65 per cent., or in other words, instead of the buckets being acted on by percussion or impact of the water upon them, they were actually moving so much faster as to transfer the percussive action to the back of the buckets, and instead of the water moving the wheel the wheel had to force its way through the water at the expense of some of its power. Now where did the wheel obtain its high velocity? Certainly not from any action of the entering water, but from the *reaction* due to the discharging water; and had the builder been cognizant of this *fact* he would have constructed his wheel differently in the upper part of the bucket, and so removed the disadvantage under which the wheel worked. To illustrate this point more fully, I will take a test of a "center vent" wheel which shows this state of affairs in its most aggravated form. Diameter of wheel 24″; running at full gate; discharging 16.62 cubic feet per second, under a head of 31 feet; revolutions per second 4.48; area of chutes at circumference of wheel or least cross action when the velocity will be the highest, 0.98 sq. feet. Then $16.62 \div 0.98 = 17$ feet per second, nearly, for the velocity of the water through the chutes and upon the wheel, which at 4.48 rev. per second × 6.23 feet cir. of wheel = 27.91 feet per second. So we have velocity of water, 17 feet per second; velocity of wheel at circumference, 27.91 feet per second, or wheel runs more than half again as fast as the water, and if any one can get percussion, except on the wrong side of the bucket out of that, I should like to see it.

I have been told by the builders of many just such wheels (see Fig. 1), that 50 per cent. of the power was obtained by percussion on the bucket, but none of these wheels ever gave a high percentage, and the wheels that have given, and do give high results, show either an absence of any curve toward the water or else they are curved away so as to present a convex surface instead of a concave one (see Fig 2). This is the best form, and the high results obtained by at least one wheel show the correctness of this theory, or rather fact.

Next comes the shaping of the bucket so as to form a tangent to a circle about ⅓ the diameter of the wheel (Fig. 3), or what amounts to the same thing, and lastly radial buckets where a downward discharge wheel is used. Now, the inference from all this shows that the turbine is a reaction and not a percussion wheel and that all effort to utilize this imaginary percussive action of the water is wasted, and the devices to attain it a hindrance to the wheel when running at its best speed, and I think I have abundant evidence to sustain me in this statement of what I have proved to be the facts, as found in a number of tests of the different wheels.

Referring to the cuts, Fig. 1 shows a "center vent" wheel with the edge of bucket turned towards the water, and then curved in an opposite direction to get the reaction which is in reality all that moves the wheel. If the curve from *a* to *b* had been continued to the edge (see dotted lines), it would have made as good and probably a better wheel, excepting that as shown in the cut the lines forming the buckets are too nearly equidistant to be extended to the edge and get sufficient opening.

In Fig. 2 is shown a downward vent wheel with buckets curved away from the water at the edge, and no matter how fast the wheel may run, the sharp edges cut through the water with very little effort, as compared with Fig. 1. For a downward vent wheel I consider this by far the best form.

Fig. 3 shows a combined central and downward vent, and, while there is no curving away from the water, the angle of the bucket is such as to prevent "slapping" on the water to any great extent, unless speeded too high. Some excellent results have been obtained with this bucket, and probably the Swain wheel which I have mentioned before as being a first rate wheel, has given as high a percentage as any of this type.

Now, such as accept my statement will still inquire, why the wheel runs faster than the water.

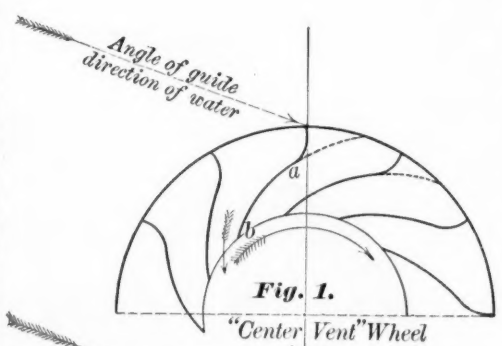


Fig. 1.
"Center Vent" Wheel

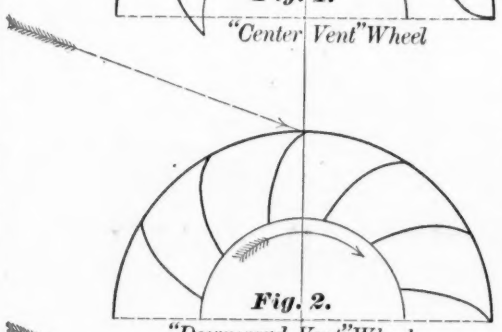


Fig. 2.
"Downward Vent" Wheel

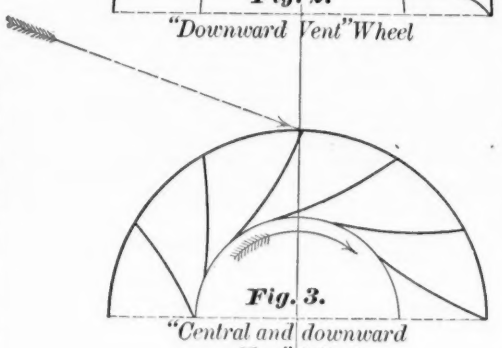


Fig. 3.
"Central and downward Vent" Wheel

I answer, because the discharging part of the bucket is nearer to the center than the receiving part, and if the inner part of the wheel takes a velocity equal to the discharging velocity of the water, the outer portion must run faster, having a greater distance to travel in the same time. And more than that, pressure and velocity can not both exist in the same space to the extent of that pressure which would be due to the head above the wheel; and, if a wheel under a head of 30 feet has a velocity of water through the chutes of 17 feet per second, equal to about 4′ 6″, and making no deduction for friction through the chutes, it leaves a pressure due to 25′ 46″ still acting on the wheel; and, as the water issuing through the contracted openings forming the discharge of the wheel must necessarily have a high velocity, it follows that its pressure must have been expended in driving the wheel backward, as action and reaction are equal; and though all the velocity due to the discharge can not be imparted to the wheel, such a part of it is, as establishes the percentage of effect. And to obtain a force due to the whole head it is under proper conditions only necessary to have the water received into the wheel under a pressure of half the head. The velocity of water through the bucket issues would then be the velocity due one-half the fall, or seven-tenths the velocity due the whole fall. The force which tends to move the wheel is equal to the area of discharge orifice multiplied by *double* the head due the velocity of discharge.

So a high percentage may be obtained, and yet only a portion of the force due to the whole head be required to act on the wheel itself, the remainder being used to force the water through the chutes, and overcome the friction in its passage, while a small percent, say, 4%, will be required to get the water away from the wheel, if it is properly constructed. But now there seems to be a tendency on the part of some builders to crowd a large quantity of water through a small wheel, and to do so it must run faster through the chutes, which are made with deep openings, and leave the wheel at a high velocity in order to get away through the small diameter allowed it. Such wheels cannot give a high percentage any more than a machine can be run at a high speed and only take the same power as when run slow. I have found center vent wheels 30″ diameter that had to use the velocity due to 13 ft out of 30 ft. head to get the water away from the central opening in the wheel after it was discharged. This alone is enough to "kill it" so far as economy goes, and yet its builders claimed 80 per cent., and seemed deeply offended because it was only given 68 per cent. at a test trial, and blamed everyone but themselves, who really were the makers of something they knew nothing about. There are lots of men, who, because they have a foundry and a shop, go into the wheel business with no more idea of what they are making than they have of where they are going when they die, and perhaps not so much in some instances. At part gate the percentage falls, owing to the increased velocity through the chute, and decreasing velocity through the wheel, owing to the reduced volume of water passing through the buckets.

And here the wheel partakes more of direct action rather than re-action, being in most cases only a flutter wheel which can only give 50 % at best. The same proportion of fall used to drive by direct action only gives one-half the power that it gives when driving by re-action.

It therefore becomes impossible to get a high percentage from direct action at part gate.

Letters from Practical Men.

ECONOMICAL WORKINGMEN.

Editor American Machinist:

In your issue of March 6th, Norman, of Chicago, complains of the losses incurred by workingmen in that city from the breaking of savings and other banks. He seems to think that it is as well for them to spend all their earnings as they go along, and have a good time while they can.

Does he not take a very one sided and superficial, not to say selfish, view of the question? Does not every good man live within his means, no matter how small they may be, and try at least to put aside something for the day of need?

While it is true that working men have lost heavily from the cause he names, they are by no means the only sufferers in the fearful ordeal the country has gone through, aggravated by speculation and outrageous taxation. Rich men by thousands have been reduced to penury. A president of a million dollar Chicago bank ended alike his troubles and his life with a bullet through his head on the steps of the Douglas monument. Only a day or two ago, the papers of that city recorded the finding of a miserable man in a basement room, huddled under some filthy rags, suffering from an incurable disease brought on by poverty and want. This unfortunate proved to be a well known citizen whose income the year before the big fire of 1871 was $30,000. He is now closing his career in the Cook county poor house.

No, let every workingman keep up his courage and live in as wholesome comfortable a manner as possible, keeping within his means and avoiding carefully habits and associations that kill both mind and body. Losses come to all, rich and poor. But every young man in this country ought to look forward to the day when he may be an employer instead of an employee—when he can be his own master, if not the master of others. This ought to be the honorable ambition of every workingman. It is within the reach of all who properly strive to attain it.

Burlington, Iowa. J. F. TALLANT.

GEARING DIRECTLY TO CRANK SHAFT.

Editor American Machinist:

The letter in your issue of Feb. 28th ult., by Mr. A. Chambers, is somewhat confusing. How would he connect his machinery if it was not directly on the crank shaft? If he will look around him, I expect he will find hundreds of engines doing their work year in and out with all the machinery connected by gearing directly to crank shaft. Nearly all flouring and rolling mills are so designed, and I believe it is the practice in England where belts are very little used.

Chicago, Ill. ALONZO G. COLLINS.

TEMPERATURE OF STEAM IN CYLINDERS.

Mr. Editor:

Last fall I made some experiments to obtain the temperature of steam in cylinders working under somewhat different conditions, that may be of interest to many of your readers. The main values of the experiments lie in the different results obtained.

Resistance to engines Nos. 1 and 3 was supplied by friction brake which worked very uniformly. Engine No. 2 was doing regular duty, drawing machinery in factory.

In each case the clearance in cylinder was added to the indicator diagram, and the highest points on the steam and compression lines were carried back to clearance line and measured to get the average pressures.

All the pressures given are above the atmosphere. In giving the temperatures due to the mean pressure obtained, Mr. Porter's table has been consulted.

Engine No. 1 was a threshing engine, mounted on horizontal boiler, and of the following dimensions:

Bore of Cylinder, 7″
Length of stroke, 8″
Revolutions per minute, 230.

The steam was distributed by a hollow piston valve, 2¾″ diam. with a travel varying from 1½″ to 2¼″, recessed in the center for admitting and cutting off steam, the ends performing the duty of exhaust. The exhaust steam from the front end of cylinder passed directly into the exhaust pipe, and from the crank end through the piston valve into same pipe. The engine used steam expansively and was governed by centrifugal weights in fly-wheel, which moved the eccentric across the shaft, changing its throw and angular advance.

The boiler was internally fired and the heat returned through 17.3″ tubes. All heating surface was below the water line. The boiler pressure was kept at about 75 lbs. per gauge during the run. The temperature was taken by one of Taylor Bro's thermometers, enclosed in a steam-tight glass case, sufficiently large to envelop the whole column of mercury in steam, and to keep it well away from contact with the metal of the cylinder. The pressure was taken with an indicator attached to same end of cylinder. There was no lagging on the cylinder, but the heat from the boiler protected it largely against loss by radiation.

Initial pressure	70	lbs.
Terminal "	15	"
Mean "	40 5	"
Mean " of exhaust and compression	10	"
Mean of the two pressures	25.25	"
Temperature of saturated steam at the above pressure	267°	
Temperature shown by thermometer	312°	

Engine No. 2 was a vertical engine with cylinder 10″ in diameter and 12″ stroke, making 216 revolutions per minute; was fitted with piston valves differing considerably from engine No. 1. The bore in steam chest was 5½″ in diameter, and was surrounded by a chamber through which the exhaust steam from lower end of cylinder must pass before entering the exhaust pipe above.

The main valve was a hollow cylinder with ends capped, which took steam in the center and through annular ports near the ends, passed it into the engine cylinder. As in No. 1, the ends of the valve opened and closed the exhaust ports. This valve was driven by a fixed eccentric. The cut-off valve worked inside of main valve, and received its motion from an eccentric controlled by weights, as in No. 1. The engine took its steam from a tubular boiler, set in brickwork in the ordinary manner. All heating surface below water line.

Boiler pressure, per gauge	69 lbs.
Initial " "	61 "
Terminal " "	11 "
Mean pressure of steam line	33 "
Mean pressure of exhaust and compression	5 lbs.
Mean of the two pressures	19 "
Temperature due steam at that pressure	257°
Temperature shown by thermometer	256°

Engine No. 3 was a vertical engine, cylinder 8″ diameter and 10″ stroke, and ran 115 revolutions per minute during the experiment. Its valve was precisely like that of No. 1, and driven in same manner. Steam was furnished by same boiler used to supply engine No. 2, but was taken through about 20 feet more of pipe that was necessary to make connection.

Boiler pressure, gauge,	57 lbs.
Initial " "	51 "
Terminal " "	11 "
Mean " of steam line	31 "
Mean pressure of exhaust and compression	13 "
Mean of the two pressures	22 "
Temperature due to 22 lbs. pressure	262°
Temperature shown by thermometer	290°

Engine No. 1 may be thrown out of the question, as its close proximity to boiler, short steam pipe, etc., would lead one to expect a somewhat higher temperature for a given pressure than in either of the others. A careful comparison of the results of Nos. 2 and 3, however, may be studied with some profit, as it shows clearly how great an element of loss lies in an unwise distribution of exhaust steam. No. 2 was supplied with steam through about 25′ of 3″ pipe, covered with asbestos, and reduced at steam chest to 2½″. No. 3 took its steam through this same pipe, and 20′ of 2″ uncovered pipe in addition. The cylinder of No. 2 was well lagged with asbestos, while that of No. 3 was bare. All the conditions, viz: Large cylinder, rotative speed, and protection against loss externally, are vastly in favor of engine No 2. Yet when working against the disadvantage of taking steam in cylinder, after it had been in contact with a large surface exposed to the condensing influence of the exhaust, we see all the precautions used to save heat more than neutralized.

The ratio of the cylinders is 100 to 64; that of the steam surface exposed to the exhaust in the two engines is 5 to 1.

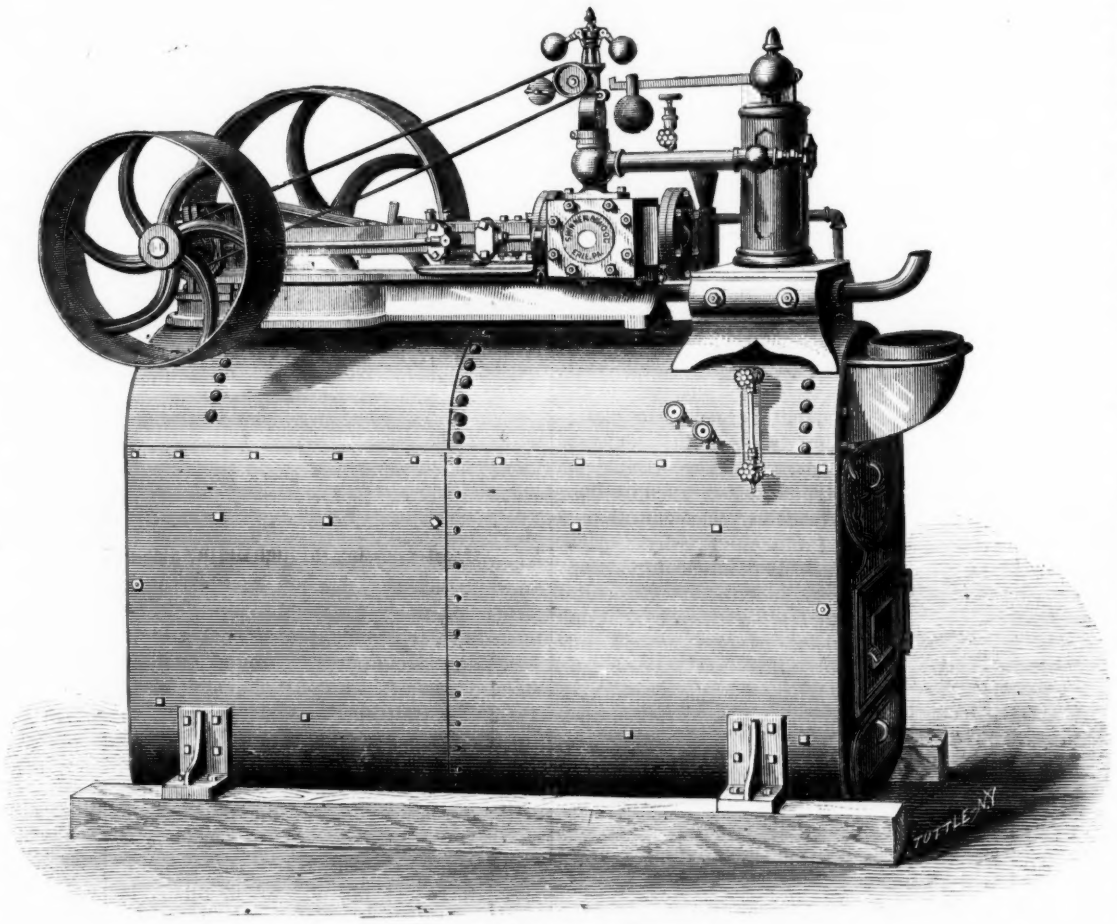
A few years ago it was quite common to find engine builders who went to some expense to core cylinders so that the exhaust steam might have a passage around them and keep them hot. That practice is about discontinued; but it is almost impossible to find an engine builder who does not let his exhaust chest cover at least one-fourth of cylinder. I know of but one engine builder—Mr. Chas. T. Porter—who seems to have any fear of the danger that lies in the neighborhood of exhaust valves. In his excellent engine, he drops the steam from each end of the cylinder as quickly as possible after using it, and I believe such disposal gives his engines an increased economy.

Harris Taber.

Corning, N. Y., March 2, 1880.

Improved Portable Engines.

The illustration on this page shows the portable engine manufactured by Skinner & Wood of Erie, Pa. These engines are built from 2½ to 15 horse power, and possess many new and valuable improvements. Among these is the stop-motion governor, requiring adjustment only when the governor belt breaks or runs off. The self-oiling connecting rod of steel and the drip-catching devices are also notable features. The builders have adopted the plan of having the piston in line with the frame, and as the latter is cast in one piece with the cylinder-head and bolted firmly to the bed there is no possibility of getting out of line. The manufacturers inform us that the cranks are of forged iron and the working rods are of steel. Another excellent feature is that every part of engine and boiler can be duplicated, which is a great advantage to a customer when he wants repairs. They print a circular showing cuts of every part of the engine in detail.



Improved Portable Engine.

The boiler is of the horizontal return-flue style, every part of which is accessible. Long wood can be used or coal as the bridge wall being adjustable to the fire box can be enlarged or contracted. We learn that this engine is meeting with good success, it being adapted to all work requiring light power. They are built either portable or detached.

A laborers' union has been organized at Povidence, R. I., to secure an increase of pay. The granite cutters have demanded $2.50 a day, instead of $2, after April 1.

The laborers of the American Iron Works, Pittsburgh, Pa., have succeeded in obtaining their demand for an advance in wages. Their wages are now $1.50 per day.

The blacksmiths at the new capitol, Albany, N. Y., have had their wages raised five cents an hour, or 40 cents per working day of eight hours.

Practical Draughting.—How to Read a Drawing—Drawing Scales.

BY T. P. PEMBERTON.

One of the great advantages resulting from a knowledge of practical draughting is, that it enables a mechanic to *read* a drawing when given him as a guide for his work. On the other hand, if a mechanic has not a knowledge of scales, and the drawings are not figured, he will find it a difficult task to work exactly to the designer's plans. It is a practice which is getting every day more general among draughtsmen, to figure exactly and minutely every part of their drawings which are drawn to a scale. Even in full-size drawings this system of figuring is not objectionable. It is a system which should be followed whenever a drawing is made "to work to," for it allows the workman to comprehend at a glance the size of his work and the pieces he has to get made. Figuring makes a drawing comprehensible even to those who cannot make drawings. It obviates the necessity of having the mechanic to measure with his rule (too often a very dirty and greasy one) the dimensions on the drawing. Still further, it allows the draughtsman to make an alteration in the size of any part by simply altering the written figure and not erasing the lines. Lastly, it adds to the correctness of the drawing—which being on paper and affected slightly by the weather—all inaccuracies will be covered by the plain written dimension, as 48″ long, or 36″ diameter; or 6″ × 4″ × 4″, etc. Drawings are almost generally made "finished size," that is, the dimensions are for the work when it is completed. Consequently all the figures written on the different parts indicate the exact size of the work when finished, without any regard to the size of the drawing itself, which may be made to any reduced and convenient scale. Drawings can be made full size, but to make them so is often inconvenient and sometimes impossible. Recourse must be had to a scale when all the parts can be delineated in proportion with as much accuracy and ease as in full-size drawings. Work of every description, and plans of buildings, machinery, or mechanical apparatus can be drawn to any of the following scales:—Half size, 6″ = 1 foot; third size, 4″ = 1 foot; fourth size, 3″ = 1 foot; fifth size, 2.4″ = 1 foot; sixth size, 2″ = 1 foot; eighth size, 1½″ = 1 foot; tenth size, 1.2″ = 1 foot; twelfth size, 1″ = 1 foot; sixteenth size, ¾″ = 1 foot; twenty-fourth size, ½″ = 1 foot; forty-eighth size, ¼″ = 1 foot; ninety-sixth size ⅛″ = 1 foot; one hundred and ninety-second size, or $\frac{1}{16}$″ = 1 foot.

In addition to these scales there are intermediate ones, such as $\frac{7}{16}$″, $\frac{5}{16}$″, $\frac{3}{32}$″, in short, any length may be set off to represent twelve inches or one foot, and this foot subdivided into twelfths or inches. In practice the scales that are mostly employed are those which are to be found on the ordinary two-feet rule. These are half size, one-fourth size, one-eighth size, one-twelfth and one-sixteenth size. These scales are easily understood and read by the workman, as being found on his standard of measurement. The best scales to work with are one-eighth and one-fourth size, viz., 1½″ equal one foot, and 3″ equal one foot. These scales are those usually adopted when the size and description of the work will allow.

There are a great many persons who cannot fully understand how to use these scales. Here, then, are some very explicit instructions. "Take off" on the compasses three inches and make a line on paper exactly this length. This is now the measurement for one foot. If any part of the work is to measure 12″, then it must be drawn as 3″.

Again, if inches of this foot are wanted: divide the three inches into twelve parts and consequently every twelfth part will represent 1″ of the scale; these subdivided again will represent half inches. Now the reader will please observe that these divisions are already to his hand, and divided off for him on the ordinary two-feet rule. Inasmuch as 3″ equal 1 foot, then ¼″ equals 1″, ⅛″ equals ½″, $\frac{1}{16}$″ equals ¼″, $\frac{1}{32}$″ equals ⅛″, $\frac{1}{64}$″ equals $\frac{1}{16}$″, and similarly with one-eighth size or 1½″ equal 1 foot, for 1½″ contain just twelve-eighths, which of course serve as inches, sixteenths as half inches, and thirty-seconds as quarter inches. The dimensions of the several parts of a drawing are frequently the result of arithmetical calculation; and for such drawings a decimal scale with tenths and twentieths must be used.

Early last week the proprietors of nearly all the pressed glassware factories of this city, says the *Journal of Industry*, Pittsburgh, Pa., received notification through committees of their workmen that an advance of ten per cent. in wages would be agreeable to the skilled hands in their employ, including pressers, gatherers and finishers. No strike was threatened, the men stating that the question would be considered further along. A meeting of the Western Flint and Lime Glass Protective Association was held on Friday last, at which the question was discussed at some length, and it was decided not to concede the advance. Notwithstanding the fact that the prices of ware have been advanced twenty per cent., this has been more than offset by an increase in the cost of raw material used in the industry amounting on the average to about thirty-three per cent., so that manufacturers are really getting less profit on their product than they were when the so-called boom set in. Figures from the books of one of the establishments show that it now costs over $800 per week more to run it than it did one year ago, and this applies to all alike. The men have chosen an inopportune time to make their demand. They counted too much, perhaps, upon the increased call for skilled labor of their class, owing to the erection of so many new factories; but we are assured that at least a portion of the manufacturers would prefer to shut down and remain idle rather than run the risk of further additions to their burdens.

The demand of the moulders at the Rosedale Foundry, Allegheny, Pa., for an advance of fifteen per cent., was promptly granted.

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☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers inventors, draughtsmen and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers who fail to receive their paper promptly will please notify us at once.*

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NEW YORK, APRIL 3, 1880.

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Machinists and other workmen, who have fallen into the habit of thinking themselves kept back from "getting a start in the world," by others more fortunate, will find something from Chordal's pen, on page 3, to set them thinking.

Questions to be Settled at the Mechanical Engineers' Organization.

Since our last issue went to press some important additional steps towards establishing the qualifications necessary for a person to procure admission to the new American Society of Mechanical Engineers have been proposed; and, as the organization and future working of this Society directly affect the interests of nearly every one of the many thousands of readers of the American Machinist, we deem it fitting that a plain statement of the facts should be made in these columns. In constituting a Society of this kind too much care can not be taken to make the standard for membership high enough to exclude those who would seek admission from mere mercenary motives, and who, from their past record, could not be expected to confer any benefit upon the Association as active workers. It would also be a serious mistake to erect, at the outset, such arbitrary technical barriers as would be insurmountable by a large proportion of the experienced and progressive mechanical engineers who wish to connect themselves with the Society, and who might be relied upon as desirable working members.

But it is not easy to determine in advance which would be the more fatal mistake in starting such an organization, namely, to narrow its membership down to a small mutual admiration society of distinguished experts, like the Royal Academy of England, or the Forty Immortals of France, or to swell its numbers without regard to fitness or unity of purpose.

It is sufficient to say, that, had it not been for the fear that such a society, if formed, would be constituted and run to suit the narrow notions of a privileged few, a national organization of mechanical engineers might have been an accomplished fact years ago.

Before proceeding further with the subject, we will refer to what we said last week about the work of the Committee on Organization. One change was made in the constitution of that committee. Prof. John E. Sweet, unable by pressure of business to attend its meetings in this city to pass upon the rules, asked to be excused from serving thereon, and his place was filled by Mr. M. N. Forney, Editor of the *Railroad Gazette*. A *vital* change in the rules approved by the preliminary meeting for founding the Society February 16th, has been proposed by the last named gentleman. Action upon the same was deferred until within a day or two of the meeting for complete organization, April 7th. The rules as first read and approved fixed the qualifications for membership as follows:

Art. 4. To be eligible as a *Member*, the candidate must have been in the practice of his profession for at least seven years, not merely as a skillful workman, but as well qualified to design and execute engineering work, and must have been in responsible charge of work in his branch of engineering.

The rules also provided that candidates for admission must be proposed by at least *five* members, to whom they must be personally known, and that a written account of the candidate's professional service must accompany the application. The application must then be passed upon by the Council (composed of the *eighteen* officers and managers of the Society), and, if approved, every member and associate of the Society should have the privilege of voting upon the candidate by *letter ballot*. Seven adverse votes are sufficient to reject his admission. It would seem that the above plan and requirements ought to insure sufficient safeguards against the receiving of improper members; more than that, it should prevent every undesirable candidate even from being passed favorably by the Council. The proposed change, however, restricts the Council to passing no candidate for membership who does not fit into at least three of the following five narrow cast iron moulds:

PROPOSED QUALIFICATIONS.

A candidate to have three of the following qualifications:

1st.—He must have been engaged for three years as the responsible designer of machinery or other engineering structures which have been built from his designs.

2d.—Have been in charge for three years of the operation or construction of machinery.

3d.—Have served an apprenticeship of three years in some engineering business.

4th.—Be a graduate or a teacher in a recognized school of engineering.

5th.—Be the author of some book on engineering, or the inventor of some "new and useful art, machine, manufacture or composition of matter" which is recognized by the Council as of sufficient value to give the candidate a claim for membership.

The wide field covered by mechanical engineering makes it extremely difficult to draw such restrictive lines as above marked out, and to thereby gauge every applicant for membership of a society representing this profession. Tried by the proposed *three by five* measure, what a concourse of able engineers, who would be most desirable acquisitions to this Society, must thus be perpetually debarred from gaining admission! To our own personal knowledge, it would exclude a number of those most influential in bringing about the first meeting to take steps in starting this Society, and who were present on that occasion, though every one of them is an experienced mechanical engineer, and worthy to take a position in the front rank. Years before the American Machinist was started, the formation of a National Society of Mechanical Engineers was urged through the columns of technical journals, and advocated by a number of leading men in the profession, yet not one took any determined steps towards a tangible organization until the calling of the preliminary meeting held at this office, February 16th. The movement then took such a positive and potential form that success seemed abundantly assured. *Now*, it is proposed by one of the organizing committee to modify the rules agreed upon at that meeting, so that they will, if passed, effectually crowd out some of those most instrumental in securing this important and desirable organization.

A large body, probably the *greater* number of mechanical engineers of well recognized ability, would decline to apply for admission to the Society upon such terms, knowing that they can not *fill* the requirements laid down for membership. Most of them have too much professional pride to seek admission upon the ground of filling merely a *part* of the prescribed qualifications. The author of "some book on mechanical engineering" is not very numerous, but it would often be better for the profession if there were even fewer of him. The leading object of this Society was declared at the outset to be "the holding of meetings for social intercourse, and the reading and discussion of professional papers; and to circulate, by means of publications among its members, the information thus obtained." This would certainly be beneficial to an author, giving him ideas to write books from, but would he be likely to give to the Society and to the public the results of his own private knowledge for free publication and distribution? Authors are accustomed to copyright their productions and have them published and sold for private benefit. However this may be, no reader of the American Machinist needs to be told that there are engineers, contributors to the technical press, practical men in the shops, and others, who are writing their names in letters of steel upon the mechanical records of the time, the results of whose work will live when some of the book-writers (and compilers) are forgotten.

One very serious result of requiring such a qualification for members would most likely be to cut off the practical men who are in position to reduce the theories to practice.

The rules already approved, set forth in the beginning, that the Society shall be composed of "Mechanical, Civil, Military, and Mining Engineers and Architects." The adoption of the *three by five* gauge for membership would practically exclude four of the five classes here designated. But we feel confident that the consideration of this remarkable Procrustean measure for membership—unlike any other ever tried by an Engineering Society in Europe or America—will result in its prompt rejection by those attending the meeting for organization, April 7th, when the question is to be definitely settled.

The Labor Problem.

The increased interest centered in the labor problem, since the development of a general revival of manufacturing business, has brought forth a variety of utterances from the press upon this subject, many of them too absurd to warrant the belief that they were the fruits of candid and deliberate consideration. A few, however, who have given the matter the careful attention it deserves, weighing well the merits of every phase presented, have given public expression to such sensible and equitable ideas, as to at once command the approval of the majority of intelligent readers. The following article from a late issue of the Boston Commercial *Bulletin*, so fully accords with the position we have always taken upon this question, that we copy it entire and commend it to thoughtful perusal:

That prices of labor will take a higher range for some time to come is to be expected, and is generally desired. Every intelligent employer in the country would be glad to have an advance of this kind occur, because he knows that no genuine revival in business or improvement in values can be established upon any other basis than an increase in the wages of the people. A considerable increase of this kind has already taken place, not only through the actual advance in the value of a day's labor which has been cheerfully conceded by many employers, but through the still greater rise which has occurred in "real wages," because of the more steady employment of workingmen all over the country. It has been pointed out that there is a distinction between nominal and real wages which should be kept clearly in mind at all times. If one workman receives $2 per day and obtains employment but 150 days in the year, while another receives but $1.50 a day and is employed 300 days out of the 365, the real wages of the latter are 50 per cent. greater that those of the former, although his nominal wages are 25 per cent. less.

This advance in real wages was a prime factor in the business revival of the past year, and was visible in the improved demand for labor upon the railroads and in the woolen mills and in all the other great industries of the country. Should the demand for labor continue to increase, the improvement in real wages will continue in a corresponding ratio, but should the demand for labor diminish, a decrease in wages would be equally inevitable. From present appearances the former contingency is the more likely to occur; and, as already asserted, it will be welcomed by every intelligent employer in the country. But it is beyond the power of ordinary individuals or corporations either to arbitrarily establish such an advance or to prevent it. The ten per cent. increase which has been obtained the present week by operatives in the Harmony Mills at Cohoes, N. Y., has been called a successful result of a strike.

But the expression is not a correct one, for if the advance was unnatural it cannot be maintained and its issue will in the end be unprofitable. On the other hand, if the advance was a natural one it would have occurred in a natural way without the resort to a strike and its accompaniment of bad feeling and waste of time and money.

It will perhaps be impossible to avert occasional labor troubles during the next few months. There are many who predict that we may expect more or less frequent resorts to the clumsy method of a strike in nearly all branches of trade. There is no general plan which can be resorted to to prevent such calamities, but their number may perhaps be reduced if employers will wisely take the initiative in establishing a good understanding with their hands, where such a thing is possible. Where an advance is foreseen to be coming in any branch of trade or in any locality, employers will be wise to unite in conceding it with a full explanation of the circumstances. It will also be wise to state that such further advances as may be warranted by the condition of business will be made without demand. Such a course has already been adopted in many cases with good results. Dealing with labor is difficult and often discouraging; but if workmen are frequently unreasonable, a broad and liberal policy is none the less wise for employers.

We have received answers enough to the screw cutting problem, which appeared in our issue of March 13, to fill several pages of the American Machinist, if they were all put into print. We regret that our crowded columns will allow of publishing only a few of them. (See Letters from Practical Men, last week).

An Important Industry.

We surrender considerable space this week to an illustrated article describing the process of sugar-making, with the aid of the latest improved machinery. The importance of this subject will be conceded, when we realize that this country is paying yearly $117,000,000 to support the slave labor of Spanish America in return for importations of an article which can and should be grown at home. The farmers of Iowa, for example, are wasting their energies in raising corn for sale, at 15 cents per bushel, notwithstanding the ample and profitable field that awaits them in sugar growing, whether beet, grape (made from corn), or sorghum sugar is considered.

To the persistent efforts of Gen. Le Duc, U. S. Commissioner of Agriculture, much credit is due for the introduction of what is known as the *Early Amber*, an improved variety of sorghum sugar-cane. This cane ripens within 90 days from the time the seed is put in the ground, and only twelve hours are required to convert it into a good quality of coffee, or C sugar of a light brown color. In other words, the cane may be standing uncut in the field *in the morning*, and may be barreled up as merchantable sugar *before night*.

The machinery requires no other fuel than the *bagasse*, as the crushed cane-stalks are called, and is entirely safe from explosion.

Instead of a steam boiler under pressure, requiring the services of a skilled engineer, only a boy's help is needed to run the machinery. We shall illustrate in a subsequent issue the machinery more especially intended for the use of sorghum growers. The farmers of any neighborhood by clubbing together, and investing $3000 in sugar machinery, suitable for farm work, have it in their power, not only to benefit themselves largely, but also to inaugurate a policy, which thousands of others throughout the country may follow with profit.

Notes of the Press.

(*From the New York Mercantile Journal.*)

Our readers recognize the name of the AMERICAN MACHINIST as one of the papers from which we often transfer excellent articles to our columns. It is certainly one of the best of our exchanges, and we are glad to congratulate it upon its success. Starting as a modest monthly, its merits soon created a demand which could only be satisfied by largely increasing its editions both in numbers and frequency. So good a friend intelligent mechanics wanted to see every week; and since its change to the weekly form it has been constantly adding to its value and usefulness. It is now crowded with hints, directions, discussions, illustrations, which the live machinist needs. We hardly know how such a one—master or workman—can spend $3.00 better than by subscribing to this paper. It is pleasant to add that the AMERICAN MACHINIST always has its telling word to utter on the right side of social and moral questions.

(*From The Monthly Union, New York.*)

A large increase in the circulation of the AMERICAN MACHINIST has compelled its printer to put in an additional press for the special accommodation of that paper. The AMERICAN MACHINIST announces that it has now reached a regular weekly circulation of 10,000 copies. It is a handsomely-printed paper, and is filled to the brim with engravings pertaining to machinery and reading matter of interest to machinists, engineers, and all other persons engaged in mechanical employments.

(*From the Great Barrington Courier.*)

The AMERICAN MACHINIST, a new claimant for the attention of practical men, after two or three years of existence has a circulation of 10,000 and a snap and vim which augurs well for an extended circulation in the near future.

The *Sanitary Engineer's* awards for plans of model school houses have been distributed. This movement should result in practical trial of some of these plans.

Business Specials.

40 cts. a line for each insertion under this head.

American Watch Tool Co., Waltham, Mass., Whitcomb Watch Makers' Lathes, and Watch, Watch Case, and Clock making Machinery.

Adjustable Incline Presses. Stiles & Parker Press Co., Middletown, Conn.

To Manufacturers and others: We are prepared to build all kinds of machinery. Patent Articles a Specialty. Correspondence Invited. Mather & Newitt, Practical Machinists, Leominster, Mass.

A new automatic valve gear for steam engines complete. Address, Ed. F. Williams, P. O. Box 148, Leadville, Colorado.

For bottom prices on Brass Castings, and Catalogue, address H. B. Morris, Ithaca, N. Y. Models and machinery to order.

First-class machinists and moulders wanted for miscellaneous work; good wages and steady employment. Address Watts, Campbell & Co., Newark, N.J.

School of Mechanical Engineering, including, besides the usual studies, practical instruction in the several trades employed. For particulars, address Richards & Dole, Springfield, Mass.

Norris & Rutter, Mechanical Draughtsmen and Patent Solicitors, 424 Walnut Street, Philadelphia.

Having sold my interest in the firm of Watts, Campbell & Co. Machine Works, Newark, N. J., I am desirous of connecting myself with some firm as Mechanical Engineer, or will act as agent for a first-class steam engine builder in New York City and vicinity. Address, Henry Parsons, No. 137 Belleville Avenue, Newark, New Jersey.

See Standard Turbine advertisement in last number.

J. F. Tallant, Engineer, Burlington, Iowa, makes a specialty of saving fuel and increasing power of defective boilers and engines.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, 65 Henry Street, Brooklyn, N. Y.

Car Builders' Dictionary. Now ready. Assigns names to kinds and parts of railroad cars, identifying each. 800 engravings, and 490 pages. Price, postage prepaid, $2. Ten copies to one address, $17.50. Published by the *Railroad Gazette*, 73 Broadway, New York.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

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Wilkinson & Crowell, 1201 Beach St., Philadelphia, make an Improved Metallic Piston Rod Packing, which is entirely automatic and of great durability. Works well at high or low pressure, and can be used in common stuffing box, or without any stuffing box at all.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

In our issue of March. 20, 1880, in the answer to question 5, the quantity of "graphite" was omitted. It should read as follows:

An excellent lubricator for heavy bearings is composed of the following: Pure tallow 2 lbs., pure graphite 6 oz., sugar of lead 4 ozs.; melt the tallow with a gentle heat, add the other ingredients, and stir until cold.

(1) J. E. M., Iowa City, Iowa, asks: To whom should I apply in this part of the country for a government license or certificate as engineer, and what would probably be required of one in an examination? *A.*—We understand from the above that you refer to the position of marine engineer, and advise you to write to Messrs. Girdon & Scott, U. S. Local Inspectors of Steam Vessels located at Galena, Ill. They will furnish you with any information that you may require respecting the position. The requirements are a thorough practical knowledge of the construction and management of steam boilers. The examination in regard to the engine is not so critical as that which refers to the boiler.

(2) C. L., New York City, asks: Please inform me whether candidates for admission to the U.S. Naval Academy, at Annapolis, as Cadet Engineers, are appointed by Congressmen (as Cadet Midshipmen), or by competitive examination? If the latter, to whom must I make application? *A.*—The applicants for admission to the U.S. Naval Academy at Annapolis, are said to be admitted by competitive examination. For information write to the U.S. Navy Department at Washington, and for co-operation apply to the Congressman of your district.

(3) A. B., Ottumwa, Iowa, asks: 1. What advantage, if any; also, what are the defects of the circular slide valve? *A.*—The principal advantages claimed for the circular slide valve are: Reduced friction, a reduction of power required to move the valve, which is attained by the application of the lever; and increased durability. The defects are the liability to leak, owing to the wear of the valve and seat. The former will wear smaller, while the latter will wear larger, thus making a bad fit between the two. The success of these valves depends largely upon the materials of which they are made, also the manner in which they are fitted up. If the seat is made of soft metal the valve should be of very hard metal, but never of the same quality. Great care is necessary in fitting the parts together. 2. What is the average number of feet of shafting that can be centered, straightened and turned to a gauge per day of ten hours? I have a 30" New Haven lathe, having a tool rest for three tools, also hardened steel boxes and a shaft straightener, running on the lathe shears. I am unable to finish more than 30 feet of shafting, 2¼" in diameter per day. *A.*—We would say that you are getting a very fair average considering your facilities.

(4) J. M. E., Brandon, Va., writes: 1. I have a bright link chain, for a small boat anchor; I wish to paint it, but find the paint will not adhere to it. Please inform me through the AMERICAN MACHINIST how this is to be done? *A.*—Dip the chain in a weak solution of muriatic acid and water in order to rust the surface of the metal. When it is thoroughly dry, apply the paint. Paint will not adhere to any bright surface. 2. Please give me the name of some practical work on "Mixing paints." *A.*—The Hand-Book of Oil Painting is a good work for young artists and amateurs.

(5) A. J. H., Newburgh, N.Y., writes: I have frequent occasion to use babbitt and other soft metals in damp places, and have experienced much trouble from the hot metal flying out of the holes owing to the dampness. I have narrowly escaped losing my eyes several times. Is there any way to prevent this occurring? *A.*—Pulverize a little resin, and drop it freely in the holes or cavities where you wish to pour the metal. It will absorb the dampness, and prevent an explosion.

(6) S. G. M., Paterson, N. J., asks: We have an argument among the men in the shop here as to the weight of a locomotive. Under which condition does a locomotive weigh the most, when the safety-valve is blowing off steam or when it is closed? *A.*—When blowing off steam, for the reason that the steam reacts upon the atmosphere, which increases the pressure upon the rails.

(7) G. F. C., Hoboken, N. J., asks: Why are the connecting rods on locomotives generally made with an oblong cross-section, or in other words, why are they made to measure more vertically than crosswise? I do not see why a round rod would not do just as well. *A.*—The object in making connecting rods with an oblong, or ▮ shaped cross-section, is to secure greater stiffness at fast speeds. The tendency to spring the rod is caused principally by the vertical vibration of the rod in following the crank, whereas there is little or no lateral vibration.

MANUFACTURES.

Babcock & Wilcox water tube boilers, have just been ordered for the American Grape Sugar Works, Buffalo, N. Y., to the extent of 3500 horse power.

The New York Dyewood Extract and Chemical Co., Brooklyn, N. Y., are putting up a new building 100 x 30 feet.

An umbrella factory is about to be erected in E. 13th St., New York, 165 x 62 feet, four stories high.

J. Stevens & Co., Chicopee Falls, Mass., are building an addition to their blacksmith shop, 35 × 24 feet.

The mills and factories of Mount Holly, N. J., are unusually busy, some of them working night and day.

The Burlington cotton mills at Winooski Falls, Vt., have ordered machinery to double their present capacity of 8,000 spindles.

E. L. Morse, 313 Olive St., St. Louis, finds the demand for his Feed Water Heater good at home, having just sold one to G. B. Allen & Co. (Fulton Foundry), for a 75 H.P. engine; another to Huse, Loomis & Co. (Ice Factory), for a 300 H.P. engine; and one to Dausman & Drummond (Tobacco), for a 60 H.P. engine. This augurs well for their success abroad.

Chas. Ervien & Bro., Philadelphia, have just finished an automatic cut-off engine of eighty-five horse-power, for Alex. Crow & Co., carpet manufacturers.

"A smoke-consuming device" has been made successful by David Sinton, of Cincinnati. Three arches placed under the boiler arrest the smoke, which, before it passes the third and lowest arch, becomes incandescent. There is a saving of twenty per cent. of the fuel.

The Allen Paper Car Wheel Co., succeeding the Hudson Paper Car Wheel Co., has passed a resolution ordering the immediate construction of works at Chicago. This organization, which absorbs all the paper wheel interests of the country, starts out with a paid up capital of $1,000,000.

The Colwell Iron Works, New York, have supplied machinery for the two beet sugar factories in the United States, namely, one at Portland, Maine, and one at Wilmington, Del. Grape sugar from corn is rapidly advancing as a permanent industry in this country, Buffalo, N. Y., being its principal headquarters at present.

The Farmer Lathe Drill and Tool Co., Leominster, Mass., are about to introduce some novel drills and machinists small tools, for which they have been preparing during the last two years.

Broderick & Bascom, wire rope manufacturers, employ about 40 men and boys at their works in the western part of the city. During last week the employes were pleasantly surprised by an advance in their wages of 10 per cent. The men employed stated that they had no intention of striking, and that the liberality of their employers would prevent such an occurrence in the future.—*St. Louis Journal of Commerce.*

The Cumberland Nail and Iron Works of Bridgeton, N. J., now pays to its employees about $5,000 per week in cash. Since last October the company has made three unsolicited advances in wages.

On the 1st of March a new rule went into effect in the United States Patent office, which is of much importance to inventors. Hereafter, no models will be required to accompany applications for letters patent, the examiners depending solely on the drawings in making up their decision.

The rolling mill of the Cherry Valley Iron Works, Leetonia, O., is idle at present, owing to a strike of the puddlers against the employment of an objectionable workman, a so-called "black sheep." The company refused to discharge the man, and say they will not do so under any circumstances, while the other side appear to be equally firm.

The Danforth Locomotive and Machine Company, of Paterson, N. J., have sustained a severe loss in the almost complete destruction of their works by fire. The total loss is estimated at $175,000; insured for about $90,000. The company is energetically engaged in the erection of new and better buildings.

A new paper mill is to be established at Niles, Mich., to be run in connection with the pulp mill of the Three Rivers Straw Pulp Company.

The Waterbury (Conn.) Brass Company are preparing to erect a new brick building same size as the rolling mill, and adjoining it on the north, to be used as a wire mill. Another building is to be added on the west of the rolling mill.

The Fulton Iron Works have completed the extensive system of machinery designed for the Bryden coking ovens in Illinois. The machinery is all constructed on original plans and drawings, being the result of the observations and studies of Mr. Andrew C. Bryden, the projector of the enterprise.—*St. Louis Journal of Commerce.*

A charter has been granted to the Connellsville Coke and Iron Company, whose purpose is to manufacture iron and steel in Fayette County, Pa. The capital is $1,000,000, divided into 20,000 shares. The corporators are mainly from Philadelphia and Mauch Chunk, prominent among them being John Leisenring, of Mauch Chunk, and John C. Bullett, of Philadelphia, owning $60,000 of stock each. The others hold about $30,000 each.

The Pittsburgh oleomargarine factory has suspended operations until the popular prejudice against counterfeit butter shall have been overcome. The projectors of the enterprise are left with considerable very expensive machinery on their hands.

Machinists' and Engineers' Supplies.

New York, March 18, 1880.

There seems to be a slight lull in the general state of the supply market this week, which is owing to a reaction of the late and sudden advance in prices. It is thought that as soon as navigation fairly opens and the weather becomes more settled, prices will be inclined to advance somewhat.

The Lehigh Valley Emery Wheel Co., of Weissport, Pa., have just issued a new price list.

Wm. Cooke, 6 Cortlandt St., N. Y., is meeting with great success in the introduction of his new Steam Boiler Tube Cleaners.

Messrs. Tallman & McFadden, importers and dealers in tools and hardware, 607 Market St., Philadelphia, Penn., have just issued a new catalogue of 160 pages, which contains indexed and illustrated descriptions of their goods.

David W. Pond, Worcester, Mass., is about placing an improved lathe upon the market.

James D. Foot, 40 Broadway, New York, is offering some bargains upon a fine quality of imported files.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of March 18, 1880:

The position of Metal Market is without material change since our last. Pig Tin in London £59.10/; Singapore, $30¼; Spot Market, nominally; Banca Tin, 24c.; Malacca & Straits, 21½c.; Billiton, Australian and English Refined, 21@2'¼c.; "Lamb & Flag," 21¼c. Pig Lead, drooping, 5¾to5¾c.; future sold at concession from these prices; Antimony, Cookson, 24c.; other brands, 19 to 20c.; Spelter, firm, @ 6¾c.; Foreign or Domestic Ingot Copper, dull, 23¾c., Nickel, $1.25. No. 1 Solder, 12¼c.; "Half-and-half," 14¼c.

Iron Review.

New York, March 18, 1880.

While as much iron is selling as usual this month, the market is rather more in favor of buyers.

Pierson & Co., 24 Broadway, N. Y., under date of March 18th, 1880, quote prices out of store as follows:

No. 1, X Pig, $41 per ton; Iron Rails, $68 to $70, according to weight; Old Rails $41 to $42; Fish Plates, 4c. per lb.; Railway Spikes, 4¾c.; Bolts and Nuts, 5½c.; Common Bar Iron, 3 7-10c., basis from store; Refined, 4c., basis; Ulster, 5¼c., basis; Machinery Steel, 7c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 7c.; Sheet Iron, 5c., basis; Angle Iron, 4 3-10c.; Tee Iron, 4 8-10c; Band Iron, 4 7-10c.; Hoop Iron, 4 8-10c. and up according to size; Horse Shoe Iron, 4 7-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets 30% off in papers, 10% off in bulk.

Boiler-makers supplies: Flange, 6¾c.; C. H. No. 1 Shell, 5¾c., C. No. 1, 4¾c.; Sheets, 4¾c. basis; Boiler Tubes, 5 and 5% discount.

WANTED.

Two first-class machinists, who have run a job on all kinds of machine tools, one a planer and one a general workman, would like to take a large job together. None need answer, unless willing to pay the highest price for good men. Reference furnished for character and ability, if required. T. B. Box 80, Worcester, Mass.

Situation wanted by a first-class Wood Pattern Maker; understands Gear Making; 16 years experience. Address, S. E. B., 104 Stratford Ave., Bridgeport, Conn.

Wanted immediately, 20 good machinists; good wages and steady employment. Fitchburg Steam Engine Co., Fitchburg, Mass.

Wanted to correspond with parties in need of a first class mechanic and draughtsman, who can design and construct modern steam power, mill work and special tools. Could act as foreman in machine shop and set up work in case of emergency. Address J. S., care American Machinist, 96 Fulton St., New York.

FOR SALE.

One Beam Engine, 12x30, $ 50.
One " 10x36, $225.
One " 6x24, $150.
One " 16x14, $300.
One Double Upright Engine, 5x12, $250.
One New Engine, 5x5, $80.
One " 5x17, $250.
Two Worthing Pumps, Steam Cylinders, 12 Water, 6 and 7, $150 each.
One Holmes & Foster No. 4, $75.
Two " " No. 2, $45 each.
One Job Pipe Cutting Machine, $50.
One Boring Bar Feed and Screw Gear, $100.
Tube Drills, comprising 30 pieces, $75.
Rendering Tank, 10x3 ft., $60.
One Flue Boiler, 26 in. x 22 ft., 2 12 in. flues, $125.
One Pair Boiler Rolls, $75.
A lot of Kettles and Flange Blocks, 2 cents per lb. for the lot.

FINNEY & HOFFMAN,
217 Water St., Brooklyn, N. Y.

JAMES D. FOOT,
40 Broadway, N. Y.,

Desires to call attention to the fact that the Files advertised in the American Machinist (issues of March 20th and 27th), are all warranted fully equal to the best makes of imported Files, and sold on the old $5.00 to the £, English List.

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Capacity to bore Cylinders 110 Inches Diameter, and turn Fly Wheels of 24 feet.

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STEAM ENGINES REPAIRED.
Address **T. P. PEMBERTON,**
Sole Agent for Hartrick & Co.
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FEED WATER HEATER,

The Most Efficient,
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No Back Pressure,
Tubes Screwed in
And Free to Expand.

No Grease in Boiler,
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Pumped whilst cold.
MOST DURABLE.

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LANE & BODLEY CO.
CINCINNATI, O.
Manufacturers of Wilson's Patent Free Open Double Disk
LEVER VALVE,
for Steam or Water, from 1¼" to 6". This valve has peculiar merits as a throttle valve for steam engines, and is well adapted to the use of a Sawyer's Valve, in place of the butterfly. Send for our catalogue and price list.

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A handy and useful dictionary of practical information for **Engineers, Machinists, Draughtsmen and Mechanics**, containing useful and reliable recipes, rules, processes, methods, practical hints, &c. **NO** medical or cookery recipes. 164 pages. This book will be sent, post-paid, on receipt of Twelve 3-cent postage stamps.

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PORTABLE
STEAM BOILERS.

Our Patents cover all Safety Valves utilizing the recoil action of steam, and familiarly known as "Pop Safety Valve."

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And Steam Users
IN THE
NEW ENGLAND STATES,

which will contain name and address of owners, and number of boilers in each establishment where steam power is used for manufacturing and other purposes.

Business men having occasion to sell goods to this class of trade, will appreciate its true value as a medium for canvassing, advertising by circular and for reference.

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The Perfection Chuck is thoroughly well-made and is a perfectly true running Chuck. Jaws and Shank of best imported tool steel. It will center and hold drills from the smallest to 3-16 inch. Shell Polished and Nickel Plated. Mechanics, Manufacturing Jewelers and Silversmiths will find this tool suited to their wants for all light work. Retail price, $1.00.

This Pin Vise is for holding all small sizes of Wire to 3-16 of an inch, also for Filing Pins, Pointing Screws, &c. It has four tempered steel jaws, a hollow wood handle, is full Nickel Plated, and the most complete tool of its class in market. Retail price, $1.00.

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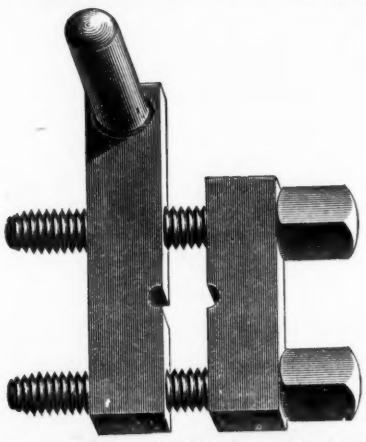

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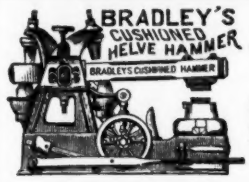

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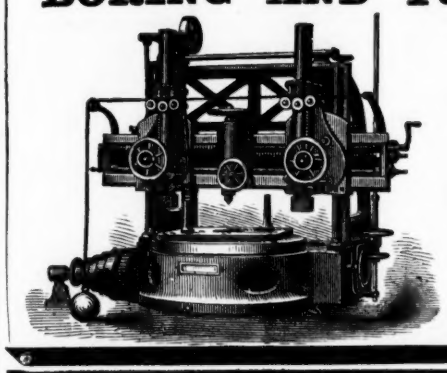

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Comprises Efficiency, Durability and Economy. Has more improvements than any engine in the market. Send for Catalogue.

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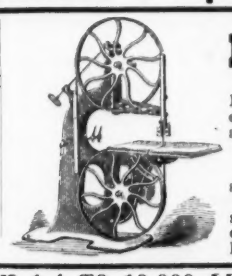

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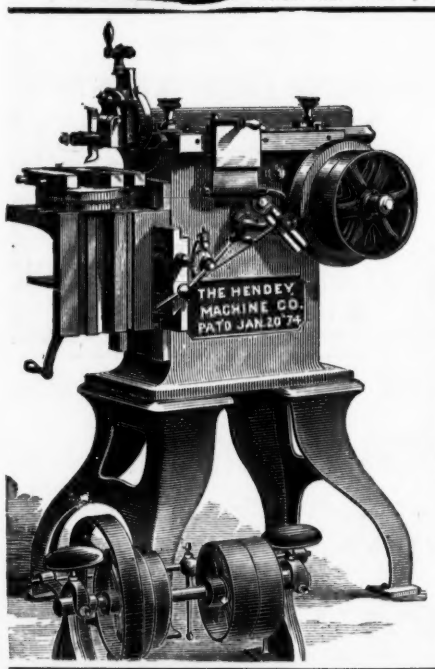

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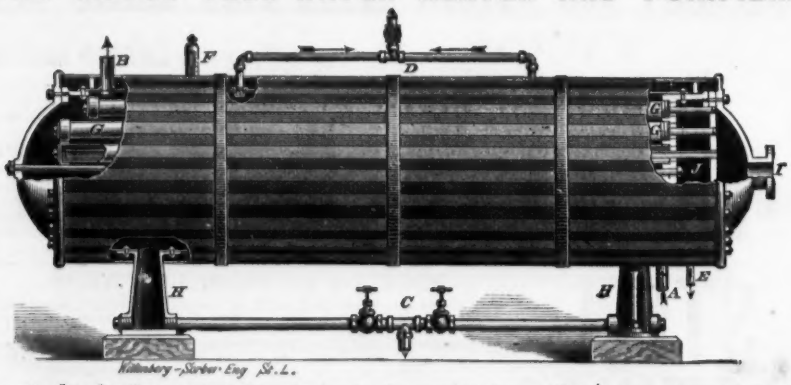

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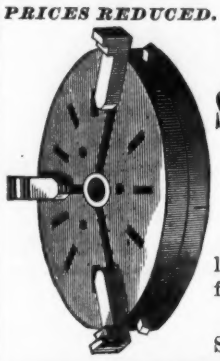

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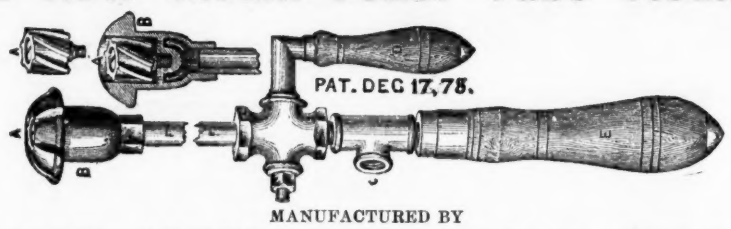

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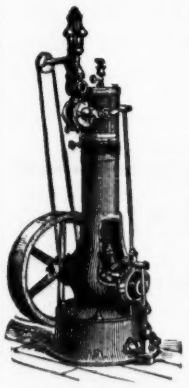

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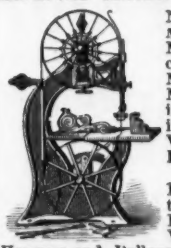

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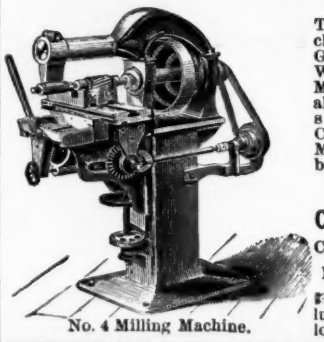

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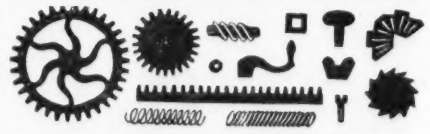

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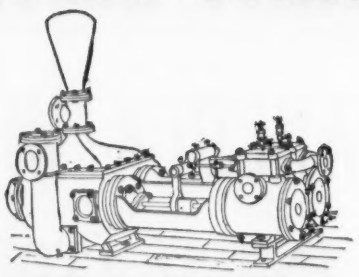

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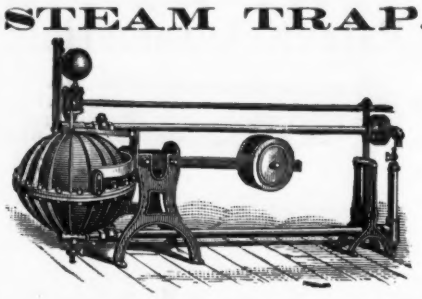

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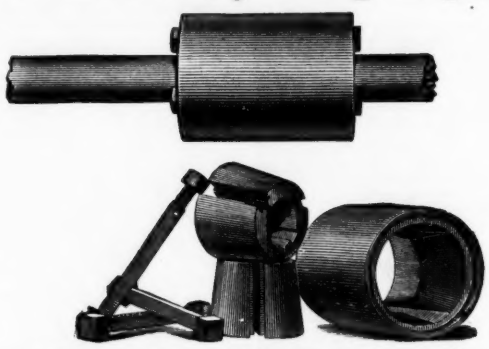

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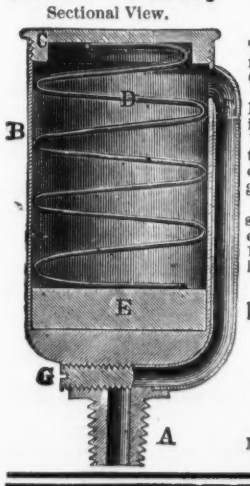

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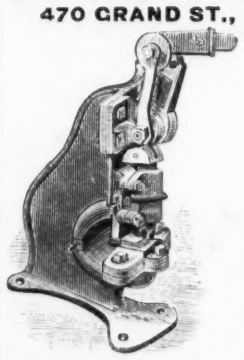

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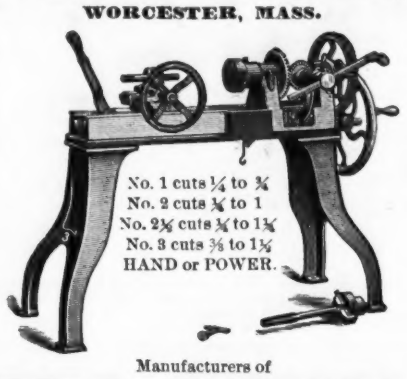

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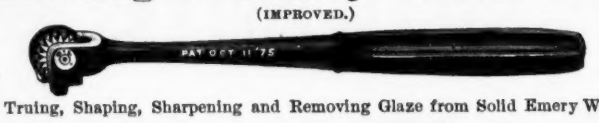

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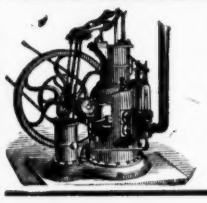

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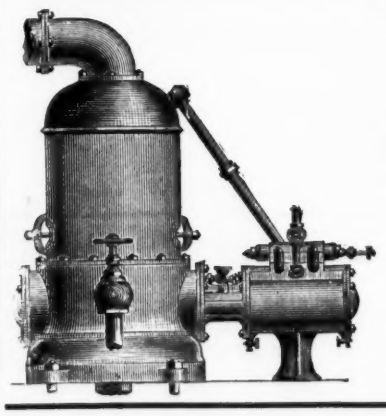

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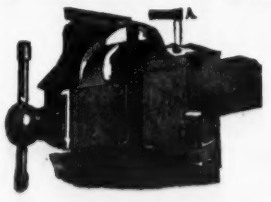

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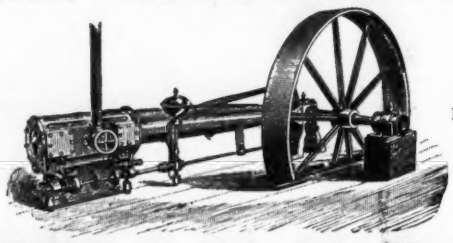

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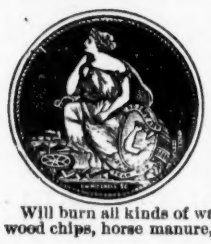

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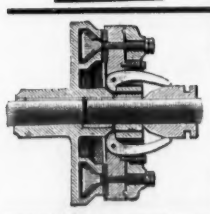

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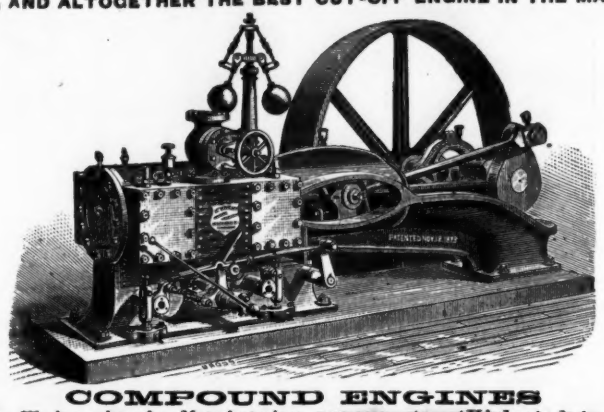

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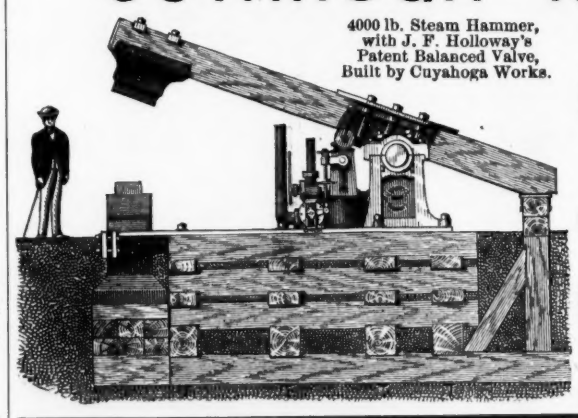

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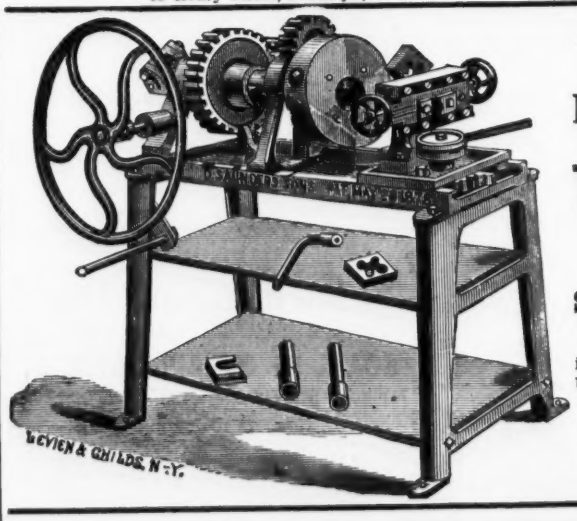

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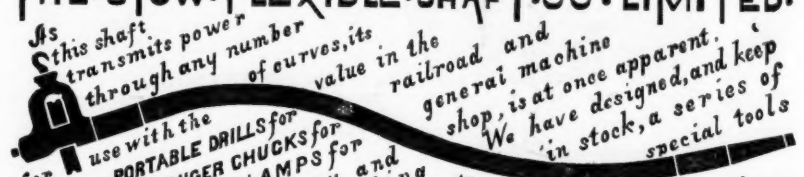
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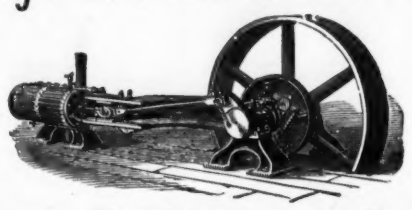

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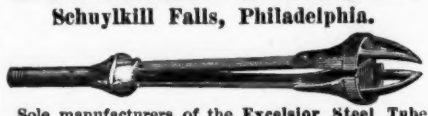

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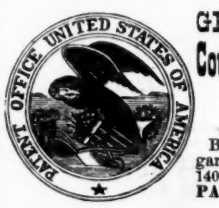

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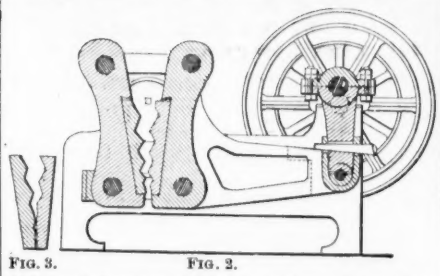

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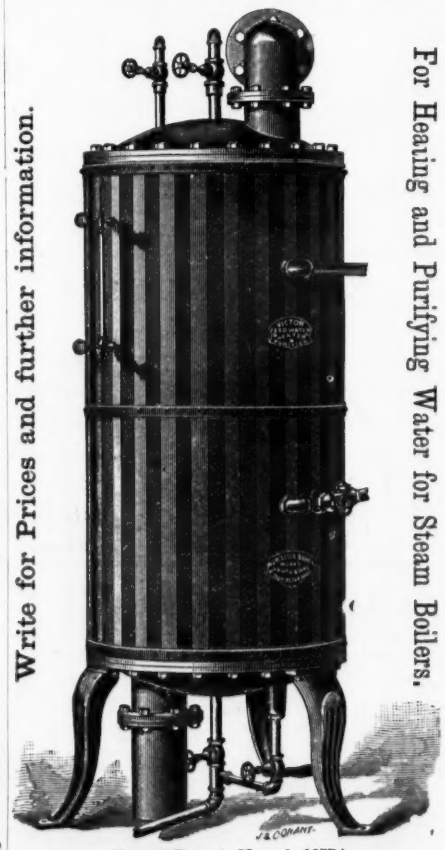

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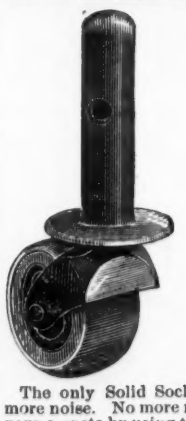

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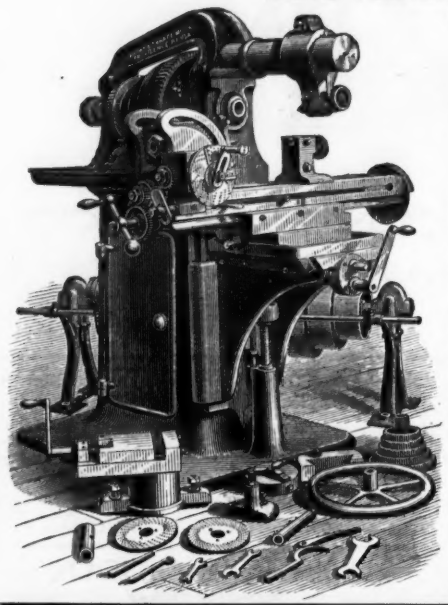

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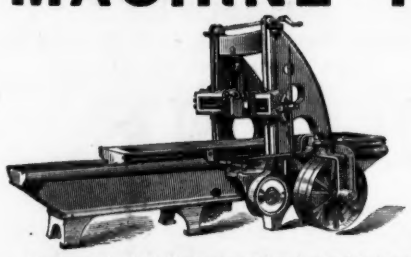

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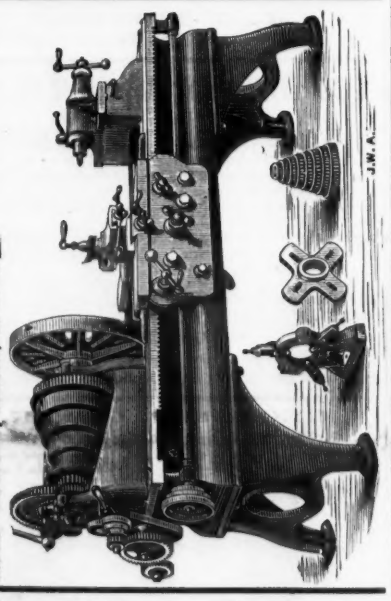

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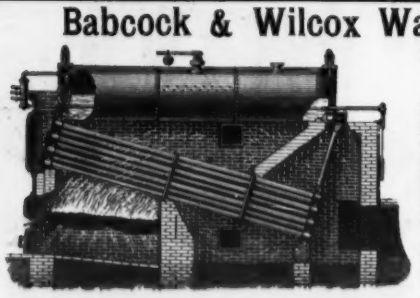

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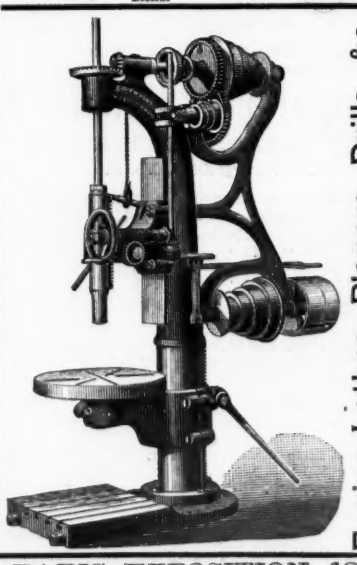

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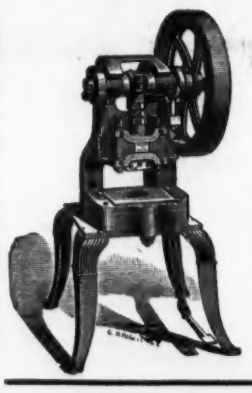

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